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The Software Developers' Magazine

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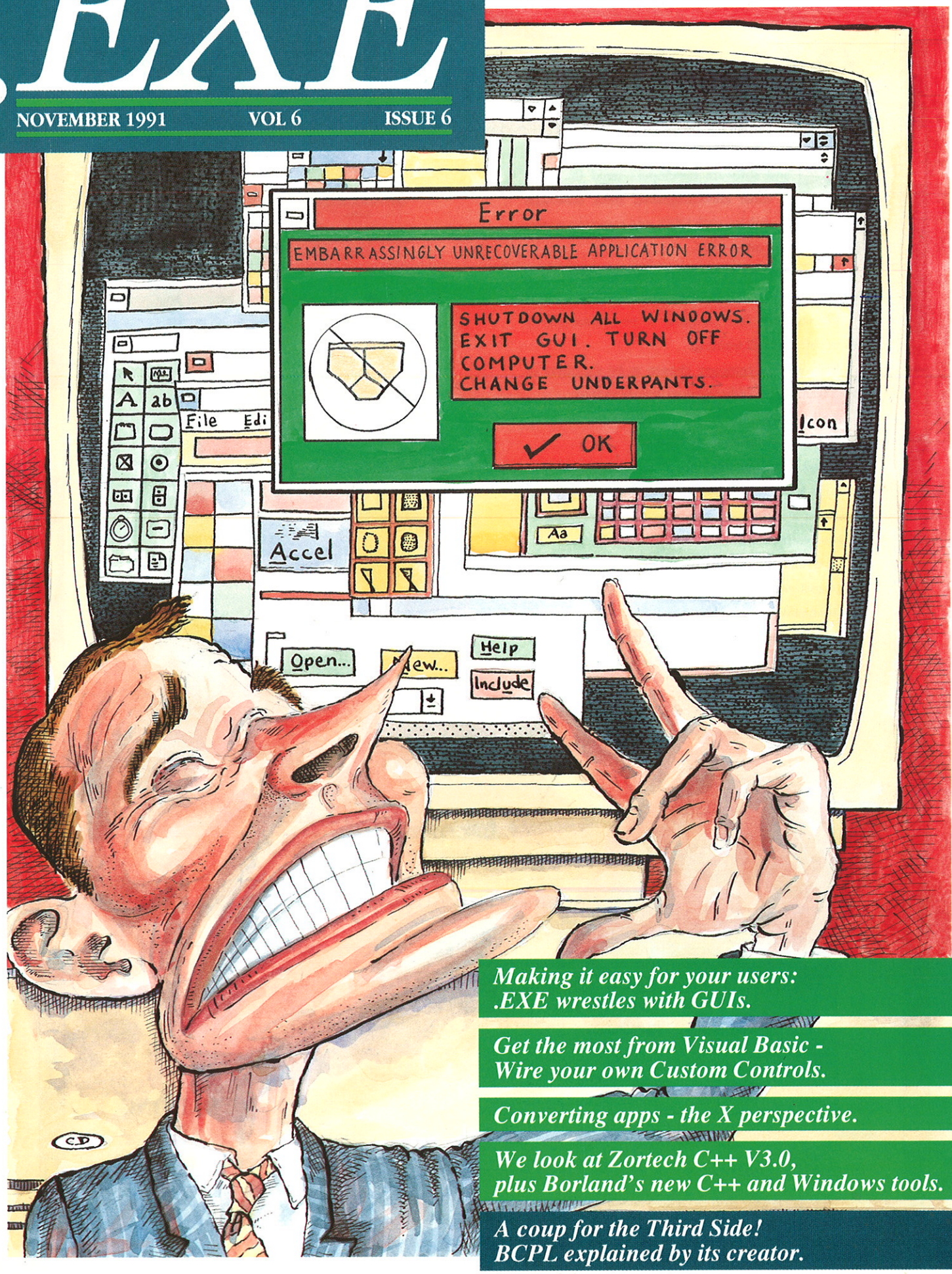

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.EXE

November 1991

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Pronunciation
The name of .EXE Magazine is pronounced to rhyme with 'not sexy magazine'.

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Issue theme: GUIs

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In which two Normans port to a GUI.

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Acorn has launched new GUI C tools for its RISCOS system. Will it attract developers to the Archimedes, wonders Jon Vogler.

ZORTECH C++ V3.0 - GRANDSON OF C++ 46
Laine Stump has been a Zortech C++ user for many years, so we sent him in to probe the secrets of V3.0.

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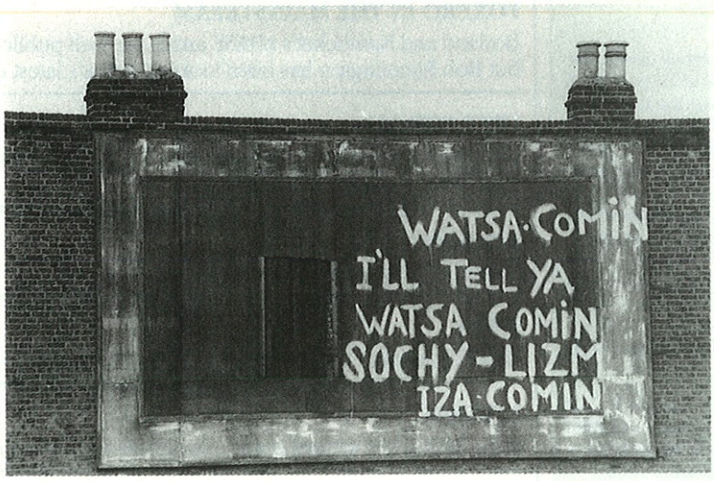
HYPA-MEDYA IZA COMIN

An old question of psychologists is 'Never mind what was taught, what was learned?' Richard H Pickard is questioning the use of a coming technology.

After reading the August issue of .EXE there were a number of little thoughts and questions left in my mind and one big one. I thought: 'at last Fortran 90 has got back to where FORTRAN IV was on the IBM 7094 (25 years ago) by bringing back variably dimensioned arrays in subroutines'. I asked myself how many investigator's questions I could answer satisfactorily about being a software engineer. I asked myself too: 'is that really how COBOL's PERFORM works for paragraphs ... I can't really remember'. I pondered on the stopping condition in the hash-based table-search routine - it seemed to need greater strength to help the method perform better than a serial search in the case where the sought item was not in the table.

All these, and the other little thoughts were about the content of the articles; the authors had made me think about what they were saying. I still remembered all these questions the next day. In psychologists' terms I had learned something. Anyway, I'd learned enough to recall the questions.



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Finally I asked myself what was the main point of Jules May's piece on hypermedia? That was a bigger question. I was a bit rattled because all I could remember the next day was the jazzy layout, coloured arrows, splodges of yellow high-lighter and something about Huxley ('Brave New World'). I'll read the piece again in a minute but I'll do some surmising first.

Perhaps it was making the point that hypermedia is expressly a form of entertainment; all it has to do is structure time for the occasional hour. It presents a target-less maze for its user to follow, and to see movies, listen to music or read a comic on the way through. Perhaps it was making the point that it is suited to being a reference library in which all cross-references are available to a user who is carrying out his or her own directed search. I didn't feel that I had learned anything unless, perhaps, the very form of the article was making its point: the hypermedia technique is aimed at the passive user. It is very exciting but it seems that all you have to do is press buttons and watch. Will it increase further the mismatch between mental activity and physical activity that television has already started?

('Seem' doesn't mean 'is'; I suppose that a hypermedia user will be able to key in notes and paste any of the exciting material into them.)

Now I've read it again. It takes some practice doesn't it? Japanese and US forces experiences show that the comic strip is one of the best methods of getting information across. That is a serial technique. Even the most modern researcher has to walk about, talk to people and wade through irrelevant material. That too is a serial technique of sorts. The difference being that the comic strip method is used for teaching and the walk-about, talk-about method is used for learning.

Now that I have read it again, what explicit message did I find? I found the content of the piece telling me that making a hypermedia database is a very complicated job indeed, that advertising copy-writers are good at getting messages across and that these clever people are very expensive.

Never mind how well books, pictures and sound are scanned into mass storage and how clearly reproduced, how well are the abstracts written and are they attributable? My fear here is that the framework or linking material will indeed be written by anonymous copy-writers. They and their publishers may have honourable intentions but every writer has a bias which clever presentation and anonymity can hide.

My hope is that these clever people will first sort out their objectives. They have to be clear as to whether they are providing teaching material or learning material. They must tell us who they are and what is their point of view.

Youngsters will easily pick up this incoming technology but uncritically. Any wrinkly who is already scared of the keyboard or the mouse will never find out what there is to criticise. It is this very distinction which concerns me; I'm not worried about the form, I am worried about the content.

EXE

The articles which generated Richard H Pickard's thoughts were by John Read, Darrel Ince, Christina Wheeler, Ray Jones and Jules May; his thanks to them for the stimulation.

Richard has programmed in FORTRAN since it was only II (and in some dozen other languages). He now applies DP technology to business problems as well as taking an active interest in the technology itself. He can be contacted on 0525 61836.

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CIRCLE NO. 246

First Fortran 90 Compiler

The Numerical Algorithms Group Ltd (NAG) is the first compiler manufacturer to release a Fortan 90 compiler. The NAG Fortran 90 compiler is currently available for the Sun 3, Apollo and Sun 4 workstations. However, a version for the PC should be available shortly. Prices start at £600 (Sun 3 and Apollo versions). For more information contact NAG on 0865 511245.

XTree upgrade

Version 2.5 of the popular XTreeGold disk management software is now available. Features include improved speed and a graphics viewer that supports several file formats. A utility to produce self-extracting zip files is also bundled. XTreeGold V2.5 costs £110. Users of version 2.0 can upgrade for £15, or £31 for earlier versions. Contact Multinational Software on 0532 703233.

Kangaroo Clipper

Nantucket has announced a marketing agreement with Matt Whelan Enterprises for the distribution of the Professional Compiler Kit for dBASE IV. Developed in Sydney, Australia, the kit consists of a custom header file that maps to dBASE IV commands, a library of Clipper user defined functions and a preprocessor. This last component scans a dBASE IV program and constructs a batch file to compile and link with Clipper 5.0. dBASE IV is not required although a copy of Clipper 5.0 obviously is. Price and distribution arrangements will be announced when the product ships, during the first week of January 1992.

Neural Network Conference

The Institution of Electrical Engineers (IEE) has organised the second international conference on Artificial Neural Networks. This will be held in Bournemouth on the 18-20 November 1991. For more information contact the IEE Conference services on 071 2401871 ext 222.

Eiffel Interest Group

The Eiffel Interest Group was launched on the 20th September to promote the use of Eiffel and provide Eiffel programmers with a forum where views and knowledge could be exchanged. It will hold regular meetings and seminars, and there will be a quarterly news letter. The first meeting, scheduled for the middle of December, will feature Dr Betrand Meyer (creator of the Eiffel Language). For more information contact Caroline Browne on 081 7801088.

AT&T C++ V3.0

Unix Systems Laboratories has released the C++ Language System V3.0 which features the first complete implementation of Stroustrup's `templates`. This provides the programmer with the ability to declare generic `template` classes without the need for macros or to fool around with `void *` pointers. It enables the compiler to perform type-checking on these container classes. The code below illustrates how a `template` could be used:

```
template<class Typ>
class stack
{
...
  Typ *p
  stack(int Size)
    { p = new Typ[Size]; }
...
}
```

```
void f()
{
  // Declare stack of
  //  20 integers.
  stack<int> sp(20);
  ...
}
```

`templates` may also be used to enable the compiler to generate type-specific versions of generic functions (such as a template for the qsort() function). Since AT&T's C++ compiler is the model on which all other C++ compilers are based, we should soon be seeing companies like Borland and Zortech shipping C++ compilers that support templates. For more information contact Unix System Laboratories Europe on 081 567 7711.

MS Developers' Conference

Times are certainly changing. At the Microsoft Windows developers' conference on the 7th - 9th October, Microsoft revealed that it would be shipping its long awaited C++ compiler (C V7.0) in the first quarter of 1992. The specification looks impressive. There will be four versions of the compiler - 16/32 bit DOS, 16/32 bit OS/2 compiler, 16/32 bit Windows and 32 bit MIPS RISC versions and these will support cross-compilation from 80x86 to MIPs and vice-versa. The documentation that will go with all of this is on par with AT&T's Unix - there's to be over 8000 pages of it! There will be several possible code optimisation settings including one that generates Packed Code (P-Code enables the size of specified functions to be reduced by up to 40% - it was used in Excel to make the DOS version run in a 1 MB machine). Microsoft will also be providing application frameworks such as GUI class libraries for Windows, although, to begin with, only foundation classes will be shipped with the compiler.

To complement C V7.0, Microsoft will be offering several new programming tools, including a Source Code Control System and CodeView for C++ (CodeView V4.0). There will also be a language independent GUI designer called MSComposer which will enable programmers to design the behaviour and appearance of their Windows GUI in a similar way to how Visual Basic works today. Microsoft will also be offering the Windows Automated Test Tool (WATT) which will automate the process of testing the user interface in a Windows application.

Microsoft also gave a sneak preview of Windows NT (a 32 bit version of Windows running on a 486 machine with 16 MB of memory). In addition to being a 32 bit operating system that can run on 386/486 PCs and MIPS RISC machines, Windows NT also supports fully pre-emptive multi-tasking (like OS/2). NT will also be able to take full advantage of multi-processor systems or, as Paul Maritz (Microsoft's Vice President for High-End systems) put it, '...a uniprocessor is the special case. It just happens to be a multi-processor machine with a single processor in it!' NT will support several file systems including DOS's FCB, OS/2's HPFS and its own file system. NT will hit the streets in 1993, says Microsoft.

Virtual reality library

WorldToolKit, from US company Sense8, is a library of over 100 C routines intended to ease the development of real time 3D simulations. Unlike most other VR systems, it is designed to run under DOS on standard 386 and 486-based PCs. 3D models are automatically imported from popular CAD file formats (such as DXF and STL) and rendered in real time. Objects can then be manipulated within models and animated in choreographed sequences. Lights may be added and surfaces textured to your heart's content. A whole range of VR input devices with exotic names are supported - the Polhemus 3Space, Ascension Bird, Spatial Systems Spaceball, CiS Geometry Ball, VPL DataGlove, Virtex CyberGlove - along with the humble mouse. The library is aimed primarily at developers of systems for architects and interior designers.

Prices of WorldToolKit start at £4,000. It is distributed in the UK by Virtual Presence Ltd who can be contacted on 071 2539699.

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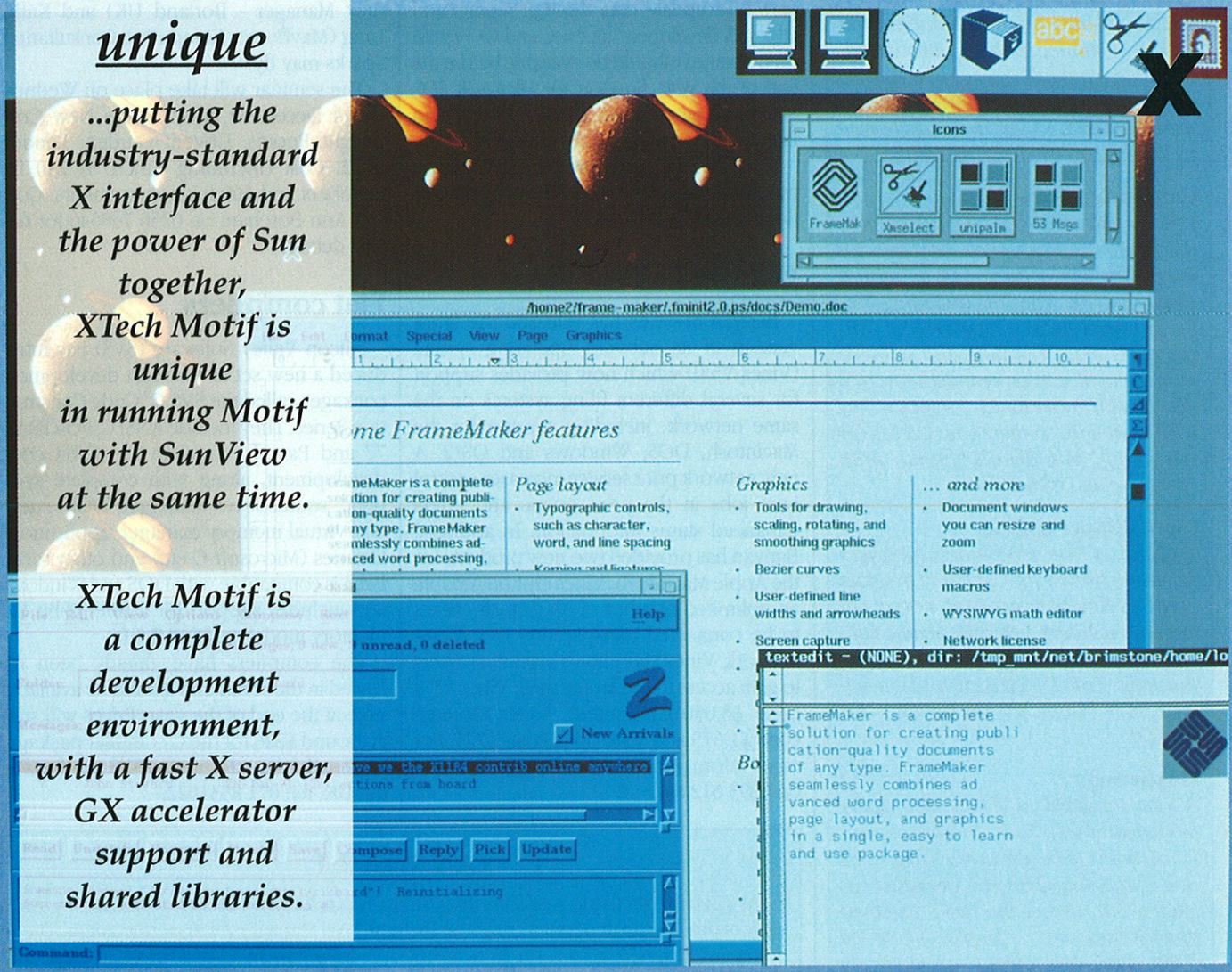

XTech Motif is an enhanced and integrated X and Motif environment for all Sun workstations. The current release is based upon X11.4 and OSF/Motif 1.1.2, and Development Kit and User Pack versions are available for all Sun architectures.

XTech Motif is developed by Unipalm, the only independent company in Europe licensed by the OSF to give the Programming with OSF/Motif course.

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CIRCLE NO. 247

Object-Oriented Rose

Rational Rose is a new graphical analysis and design tool that supports object-oriented methodologies. It provides language independent analysis and design for the IBM RS/6000 and Sun Sparcstation workstations. It can also be used from any X Window terminal that is running Motif or Open Look. Rose includes an object-oriented database and desktop publishing package, although Rational does provide a set of interfaces to enable integration with third-party software. Rose costs $3,995 and is distributed by Rational on 0101 408 4963692.

Unicom Seminars

Unicom has arranged four seminars at the Heathrow Park Hotel between 2-5 December 1991. There will be several speakers at the seminars including Professor Darrel Ince (a regular .EXE contributor). Readers of .EXE and Software Management will be entitled to a 10% discount on the fee for each seminar they wish to attend, so there's no excuse for not going. For details, phone Julia Valentine on 0895 256484.

Latest Clipper Library

Tools II is a new version of Nantucket's extension library for Clipper. It provides over 550 functions covering several categories including networks, mathematical calculation and windowing functions. Tools II costs £250 and is available from Nantucket UK Ltd on 0707 373600.

Floppy Sony

A new standard in floppy disk drives looks nearer with Sony's release of what it's claiming to be 'the world's first 4 MB unit', providing 2.88 MB formatted capacity (but doesn't the NeXT machine already have one?). Samples of both the 3.5in drive and media are currently being made available to OEMs, VARs and systems integrators. The MP-F40W is fully compatible with Sony's existing generation of 1 MB and 2 MB floppy drives and still comes in the same 1" high outline.

PenForms

New from Victor Technologies comes PenForms, a simple low-cost forms creation tool for its GRiD Pen-PC handheld computer. Screen layouts are first designed on a desktop PC and then loaded onto the Pen-PC for use in the field. The product can be used as the basis for software development for the GRiD machine. PenForms costs £195 for the desktop PC version and £95 for each Pen-PC. For more info, ring Victor Technologies on 0494 461600.

Relational Windows

After its first public outing at the Business Computing Show in September, WindowBase from Software Products International is now shipping. The product is a relational database management system for Windows 3 with full SQL and DDE support. A graphical forms designer is included, plus facilities to view and update data through reports and tables. A developers' kit for C and C++ (with class libraries) should be available before the end of the year. Support for Microsoft SQL Server and gateways to dBASE, B-Trieve and Paradox file formats are also planned.

WindowBase retails at £395 and can be purchased from Software Products International tel: 0734 844081.

Feature-Packed Vines

Banyan Systems has released the latest version of its network operating system (Vines V5.0) which now provides support for several different filing systems on the same network, including support for the Macintosh, DOS, Windows and OS/2. A new network print service increases control over jobs in the print queue and offers enhanced status information. In addition, Banyan has provided two new products for the Apple Macintosh. Vines Options enable an unlimited number of Macintosh clients to be connected transparently to a Vines network. Vines Mail allows Macintosh users to gain access to electronic mail. Vines V5.0 costs £6,050 (unlimited). Vines Options costs £1,675 and Vines Mail costs £775. For more information contact Banyan Systems on 0293 612284.

dBATE Seminar

Responding to anxiety in the marketplace, the dBASE User Group is organising a seminar entitled 'The future of the dBASE/xBASE language'. Speakers will be George Fletcher (MD - Nantucket UK), Mark Daeche (European Business Manager - Fox Software), Peter Reiks (Database Product Manager - Borland UK) and Kathy Lang (Mayflower Computing Consultants). Sparks may fly.

The seminar will take place on Wednesday 4 December, 1991 at the New Connaught Rooms, Covent Garden, London WC2. Cost (including lunch) is £40 for members and £60 for non-members. Contact Ann Boreham on 0256 768646 for further details.

Flat compilers

Silicon Valley Software (SVS) has introduced a new set of low-cost development packages called the SVS C^3 Code Construction Series. They include ANSI C, FORTRAN 77 and Pascal compilers for 32-bit code development, along with complete symbolic, source-level debugger, DOS extender, virtual memory manager, applications libraries (Microsoft C etc) and other tools. Each is compatible with DOS and Windows and includes support for a true 32-bit flat memory model and DPMI 1.0.

The compilers have already been released in the States and should be available here at the end of the year. Prices will start at around £220 for the C compiler package. System Science distributes SVS products in the UK, tel: 071 8331022.

LAN Man 2.1

At a recent Microsoft press briefing, there was a lot of excitement (mainly on the part of the Microsoft personnel) about the new LAN Manager 2.1 announcement. The company is pushing hard for its network operating system to be seen as a superior alternative to Novell's NetWare in the client-server market. Major new features include enhanced Windows connectivity, NetWare connectivity and TCP/IP support. A hardware-independent version of OS/2 1.31, optimised for the server, is also included in the box. In addition, a number of new products based on LAN Man 2.1 will be available. These are a Remote Access Service (for dialling in to a LAN Man network); Services for Macintosh; a toolkit for Visual Basic and a bag of TCP/IP utilities.

Microsoft is now also shipping LAN Manager 2.0 for UNIX systems to its OEMs, and DEC has firmly committed to basing its Pathworks product on LAN Manager. Phil Buggins, Microsoft UK's Network Business manager, stated that future versions of LAN Manager would certainly support OS/2 V2.0 as a client operating system, cautiously adding 'and as a server platform when it is stable'. Support for OS/2 1.x servers will continue, although Microsoft will obviously be keen to migrate OS/2 users to Windows NT when it finally emerges.

LAN Manager version 2.1 should be in the shops for Christmas and will come with a new pricing scheme. Minimum price for a 1-10 user pack (bundled with OS/2 1.31) will be £1,595. An upgrade from version 2.0 will cost £375 or £1,195 for a global upgrade. Various LAN Manager add-ons will be priced as follows: Services for Macintosh - £795; Remote Access Service - 1,595; TCP/IP Utilities - £150; Toolkit for Visual Basic - £99; 3Com Upgrade Toolkit - £125. Microsoft is on 0734 500741.

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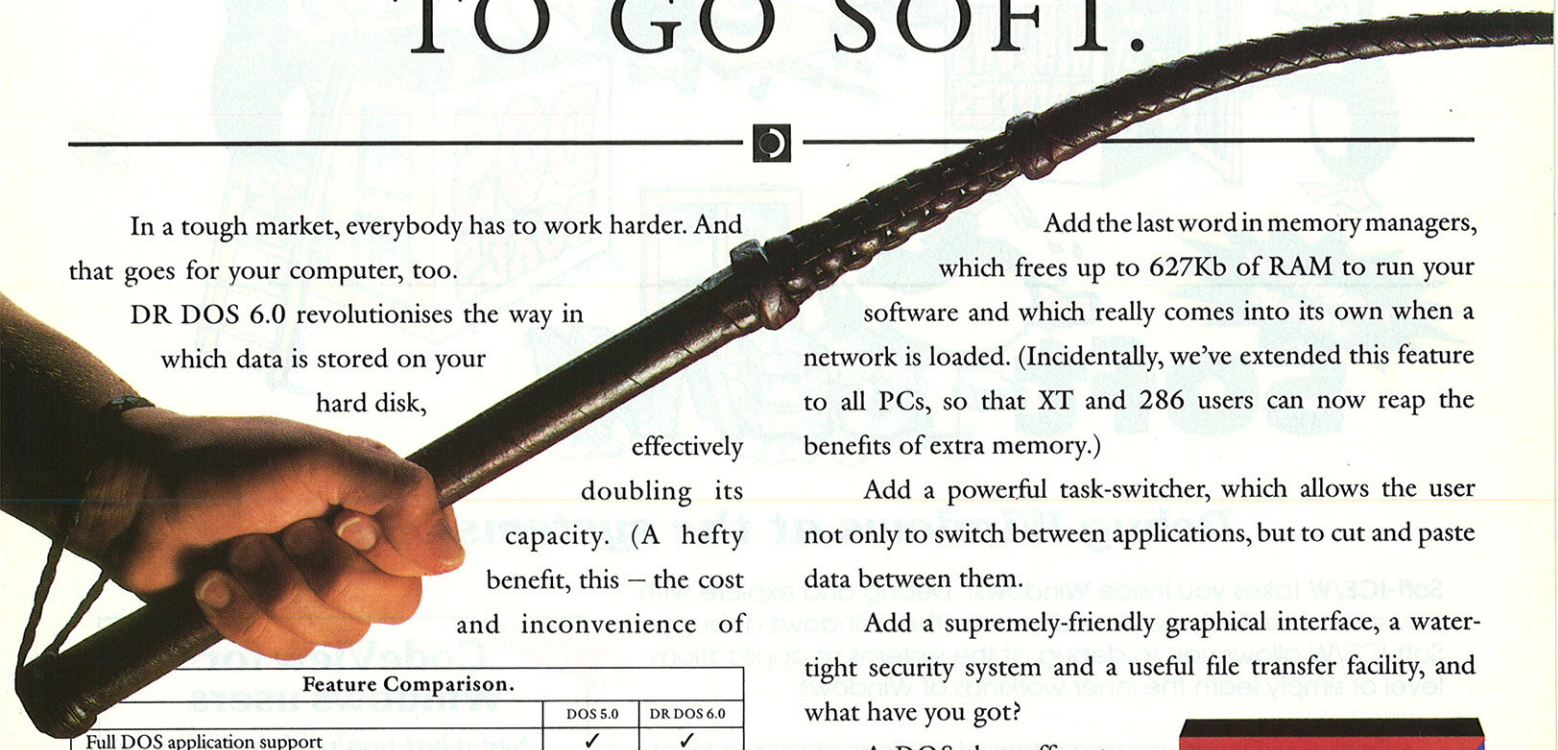

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Disk optimiser	–	✓
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Password security system	–	✓
PC-to-PC file transfer utility	–	✓

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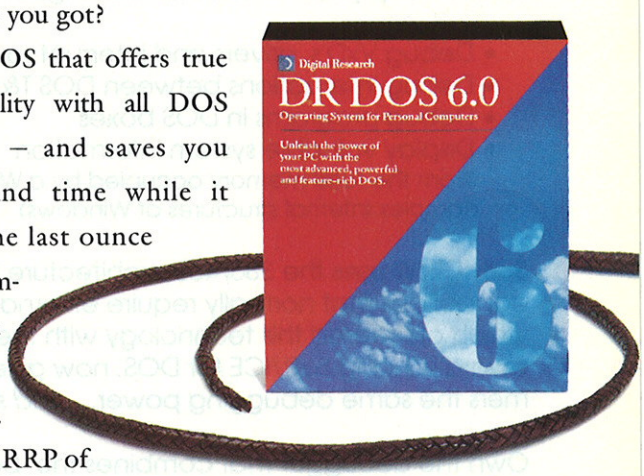

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CIRCLE NO. 248

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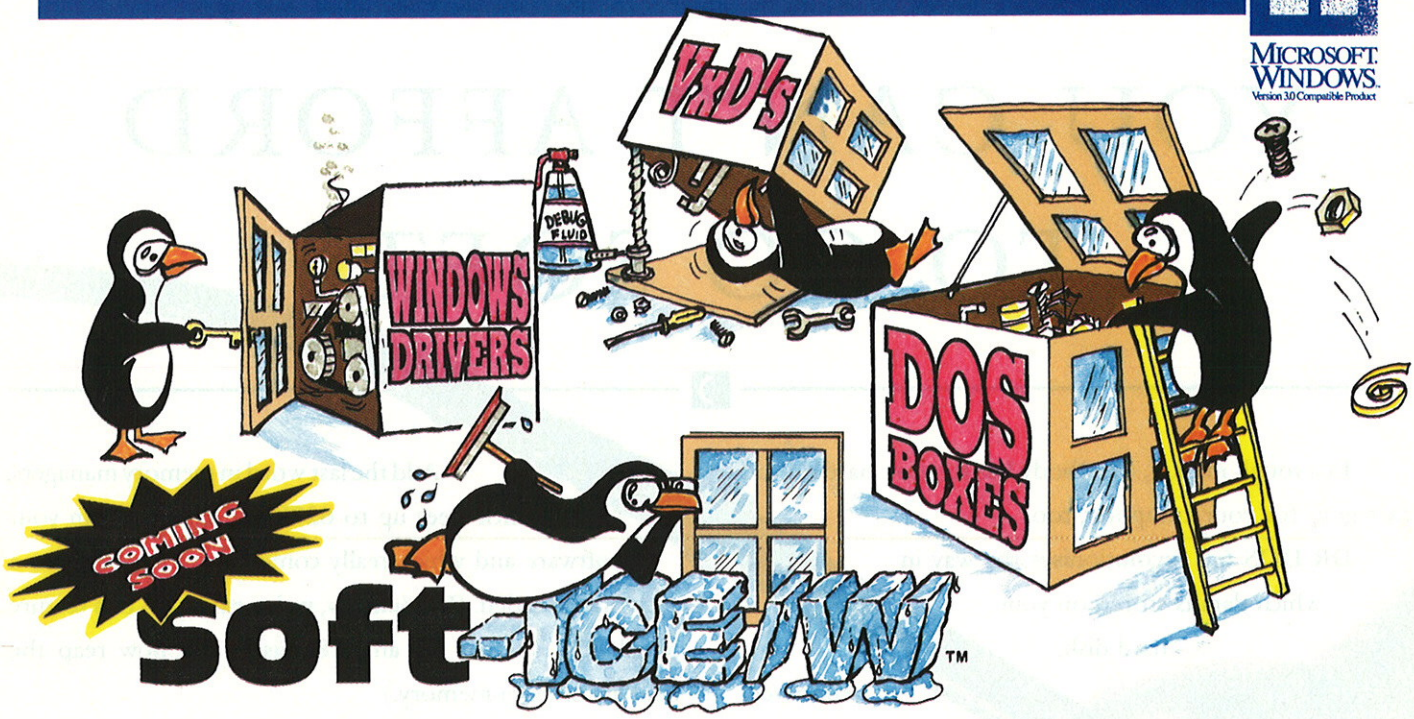

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CIRCLE NO. 249

Unifying UNIX

UNIX developers must be breathing a sigh of relief at the announcement of an agreement between members of the Advanced Computing Environment (ACE) initiative and UNIX System Laboratories (USL) on a common set of APIs for the ACE UNIX environment. The agreement enables systems based on the Open Software Foundation's OSF/1 operating system or USL's UNIX System V, Release 4 (SVR4) to provide a common set of source-compatible application interfaces, allowing developers to write applications that will run on all ACE UNIX platforms.

The announcement represents a major step forward in resolving the battle between OSF/1 and SVR4 based UNIX systems. As part of this effort, USL has announced that it is joining the ACE initiative and will ensure that its ACE SVR4-based product family supports the same set of interfaces that include OSF's Application Environment Specification (AES), Motif GUI and Distributed Computing Environment (DCE).

The ACE initiative, founded by Compaq, DEC, Microsoft, MIPS and SCO in April of this year, is designed to create a new industry standard Advanced Computing Environment encompassing computing platforms based on either of two microprocessor families (the MIPS RISC R3000/R4000 and Intel x86). Since then, there has been friction with UNIX System Laboratories, a subsidiary of AT&T, over its own standard SVR4 operating system.

Extensive Comms Library

Greenleaf's CommLib Level 2 V3.2 provides several new additions to the CommLib asynchronous communication library. There is now a total of 12 device drivers and support for XMODEM, YMODEM, ZMODEM, Kermit and ASCII file transfer protocols. In addition, Commlib features several handshaking protocols including XON/XOFF, RTS/CTS and DTR/DSR. Enhancements have also been made to Kermit, which now has the ability to use data compression selectively. Drivers have been provided for both the Phar-Lap 286 Dos-Extender and the Rational Systems DOS/16M extender. CommLib V3.2 costs $359 (including complete source code and free technical support) and supports several compilers including Borland C++, Microsoft C, Watcom C and Zortech C++. Greenleaf can be contacted on 0101 214 2482561.

New Embedded DOS

Great Western Instruments Ltd has begun shipping a new ROMable version of DOS for real time applications called Embedded DOS which is claimed to be compatible with MSDOS 3.1 and adds multi-tasking. Features for multi-tasking support include Lighweight Threads (which reduce the overhead of completely saving a task's context by storing minimal information) and Semaphores. It is able to take full advantage of multi-processor systems (like Compaq's SystemPro) by providing a Lock mechanism for controlling access to shared memory. Embedded DOS's File System Driver Interface enables several file systems to be added. The entire kernel takes up less than 40 KB of memory and can be linked directly with application code to form a bound application. All of Embedded DOS's features are fully supported when running on a PC, enabling developers to use a PC for testing and debugging. A Developer's Kit, which includes source code for COMMAND.COM and device drivers, is available for £455. For more information contact Great Western Instruments on 0761 452116.

Trail Blaiser

Boston-based Blaise Computing Inc has enhanced its family of GUI development products with the release of several upgrades and a new set of custom controls for Windows 3. The Windows Control Palette is a collection of custom control classes and associated functions that provide improved interface objects in much the same way as Borland's ObjectWindows (see elsewhere in this issue). Packaged as a DLL, the product is compatible with C, C++, Turbo Pascal, Visual Basic and Actor.

Version 2.1 of the company's Win++ GUI class library for Windows (*.EXE August '91*) is also now available. The release incorporates over 30 new C++ classes, including full DDEML support. In addition, support for C++ has been added in version 2.0 of Blaise's Turbo Vision Development Toolkit. The product is a set of utilities and a class library designed for use with Borland's Turbo Vision. Included are a resource editor, a utility to convert Turbo Vision resources into Windows resource script files and class libraries that extend Turbo Vision's capabilities.

The Windows Control Palette comes with source code and costs $149. Win++ V2.1 is priced at $249 and also includes source and examples. The Turbo Vision Development Toolkit (TVDT) V2.0 costs $149. Blaise can be contacted on 010 1 5105405441. TVDT and the Windows Control Palette had not reached UK distributors at the time of writing. Grey Matter (tel 0364 53499) quoted us £160 for Win++.

Panel Plus for Windows

Roundhill Computer Systems will be releasing version 2.2 of its Panel Plus II screen manager library in December '91. Several new features have been added including support for Windows. Existing Panel Plus applications only have to be recompiled in order to run under Windows. The Panel Plus facility for loading screen layouts at run-time can now be accomplished by loading them from the application's resource data. The library is supplied as a DLL and will cost £285. For more information, Roundhill Computers can be contacted on 0672 84535.

Novell Net-Guard

Net-Guard is a new product from Airtech Computer Security which provides the System Administrator with a single tool for guarding Novell networks against misuse. A network workstation can be prevented from making local copies of certain files and its printer and comms ports can be disabled in order to prevent output to any destination. All of this can be done from the System Administrator's own PC. In addition, it also keeps a Log File of all transactions on the network, and this can be used to provide evidence of malicious practices. Net-Guard costs £1750 for a ten workstation licence. For more information contact Airtech Computer Security on 0844 201800.

Pocket-sized ISDN

Wimbledon-based communications specialist, Dataflex Design, is now shipping its battery-powered ISDN adaptor for BT's new integrated services digital network (ISDN-2) service. Smaller than a Sony Walkman, the Pocket ISDN adaptor complies with the BTNR191 Basic Rate Interface standard and is fully BABT approved. It uses the standard Hayes AT commands for call set-up and progression. The Pocket ISDN Adaptor is priced at £595. Dataflex is on 081 5436417.

Whoops!

There were a few misprints in our October issue. First, the Software Training Guide issued in last month's copy of .EXE has an error: for courses where the host company is listed as ICTL, the contact is Sally Pocock at ICL Training Services, ICL Training, Beaumont, Burfield Road, Old Windsor, Berks SL4 2JP, Tel 0753 851483 or 0753 841 775. Second, the correct telephone number for Marscot Ltd (News, page 6 - 'Hard Disk Protection') is 0383 416 098. Sorry!

Letters

We welcome short letters on any subject that is relevant to software development. Please write to The Editor, .EXE Magazine, 10 Barley Mow Passage, Chiswick, London W4 4PH. Unless your letter is marked 'Not for Publication', it will be considered for inclusion on this page.

More trouble

Sir,

I read with interest the article 'The trouble with `getchar()`' (.EXE October '91). Working example programs are often the best way of getting to grips with the esoterica of UNIX. However, I must point out a couple of problems with the program.

The first concerns the use of the `nap()` function. `nap()` is a Xenix extension to UNIX, and is not available on many UNIX versions. In fact, it is a major limitation of some UNIX variants, including System V.2, that there is no portable way of waiting for less than a second. Some UNIX versions (including most Berkeley derivatives), support calls based on `struct timeval`, which allow short waits via the `select()` call, while most recent versions of System V support the `poll()` command, which can be used to delay for `n` milliseconds as follows:

```
int x;
poll(&x,0,n);
```

The other important point is that the terminal handling, described in `setraw()` etc, is System V specific and will not work on Berkeley UNIX at all.

Finally, there is a more elegant way of achieving the result required of the `cready()` function. Rather than using `nap` and `O_NDELAY`, just use `ioctl` to set `min = 0, time = 1`, after which `read` will return after 1/20 second with either 0 or 1 `chars`, just as required. This may be the alternative which was rejected in the article because of debugging problems; but if that's the case, all I can suggest is a change of debugger. I use SCO UNIX/gdb and have no problems.

Gary Bilkus
London

Case for CASE

Sir

Brad Cox *(.EXE October '91)* has been misled if he thinks CASE tools are 'all oriented towards churning the code out; about implementing, not specifying'. Properly used, CASE tools address all stages of the development process: particularly the often neglected analysis phase. It is a central feature of many structured methods (for example Ward/Mellor) that system development should commence with the production of an implementation-independent essential model, which describes **what** the system should do, not **how**. Good CASE tools (I use Westmount) support this modelling process.

Brad also claims that 'we have no technologies for doing [specification] today'. Formal specification may not yet be widely applied in industry, however he should be aware that several well-tried specification methods exist. The popular 'Z' specification language, based on simple mathematics, could easily be used to specify Brad's stack example in an implementation independent manner.

Colin Rutland
Hidestamp Ltd
Macclesfield

Quarterdeck Speaks

Sir,

Quarterdeck software creates great passion amongst its followers *(see Letters, .EXE Oct '91)* because it contains so much that is not apparent from our US devised adverts and sales literature. Users who get into the product keep on stumbling over fabulous 'unpromoted' features - like Scripts - and can become quite boring as they try to evangelise their colleagues.

If you were a DESQview aficionado, you would not have bothered to ask for comments on the 'phenomenon', it would be self-apparent.

Once the working way of life has become wrapped around DESQview, it's impossible to change. DESQview users create friction in certain programming circles by being ready to rubbish Windows for failing to match the speed, performance and general combination of simplicity and 'customisation'.

The reason your 'programmers' may not enjoy DESQview is that it is one of the more tiresome arbiters of IBM compatibility and the behaviour of software. It will tend to spoil their memory violations and other naughty practices. So the rigidity of OS/2 rules may suit lazy programmers seeking a little discipline to save themselves from their own bad habits.

We go to great lengths to publish our own rules for making the most of DESQview in the form of API manuals, but mostly we are expected to run ordinary DOS applications. In the US, the influence of DESQview means that Quarterdeck spends a good deal of time working with software developers on issues of multitasking and memory management. DESQview isn't treated as some sort of imposition, but programmers use the product and Quarterdeck's expertise to help them make the most of their effort.

The latest versions of both DESQview and QEMM offer yet more to the operator of the genuinely 100% compatible PC, including the unexpected 'stealth' feature that allows ROM address space to be used for High RAM. This is real smoke and mirrors technology at the extremity of system design, and not surprisingly can identify incompatible systems quite readily.

So if you have one of those clones that cannot use all the features that are available to 100% compatible users, then the answer - however much you may not want to hear it - just may be that your system is not 100% IBM compatible.

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Now that DOS 5 has accepted the validity of 'high RAM' it's a good thing that there is such a product as QEMM6 that conclusively flushes out the marginal systems and will hopefully encourage OEMs who have excused themselves and their BIOS in the past by suggesting that anything above 640 KB was not the users' business anyway.

In fact, if I was IBM - and any supplier of software for 'IBM Compatibles' - I would do my damnedest to see that QEMM6 became a *de facto* standard for all PC users so it could find out clone makers who are not 100% compatible. There are a couple of big European OEMs who are particularly in need of being more careful about their BIOS compatibility.

QEMM is already outselling Windows 3 in the US charts published in PC Magazine (and has done for many weeks now) so the issue in the US is not 'is QEMM compatible with XYZ', but 'is XYZ compatible with QEMM'.

I would hope that you and your readers would like to be positive about a product which has gone a long way to providing a much-needed benchmark for well-behaved software and systems in the US, and accept that the idea would serve certain European OEMs - and their customers - equally well.

William Poel
General Manager, Quarterdeck UK
Chelmsford

OS/2 2 tutu too too

Sir

It's all very well .EXE dedicating an issue *(October '91)* to UNIX, but what about OS/2? .EXE already has a UNIX columnist, and frequently reviews UNIX-specific products, for example the Zortech compiler for Xenix. The only references to OS/2 were either so-called attempts at humour (as in the pathetic 'OS/2 2 tutu too' cartoon), in a patronising editorial reply to a letter ('What will be the main benefit of OS/2 2.0?' - 'We won't have to use DESQview') and in Mr May's foaming opinion piece.

Where are the reviews of OS/2-specific utilities? Where are the technical hints for programming in PM (which, as anybody will know who has tried it, is vastly superior to its Windows equivalent). .EXE used to offer a deep and rich coverage of OS/2. Where has this gone? There **is** life beyond DOS and UNIX. Pull out your finger, .EXE, and start writing for ALL your readers.

L Redfern
Cambs

Following our readership survey, the content of .EXE is under review to ensure that editorial content accurately reflects the requirements and interests of our readers. More on this next issue - Ed.

Not Quarterdeck again

Sir

Perhaps the polarising effect on programmers is not Quarterdeck but in fact **Microsoft**. I have heard more polarised viewpoints on Windows than DESQview; either because it **is** a Microsoft product or because greater quantities have been sold.

Like it or lump it, the teams for the play-off are:

Windows 3.0	*Microsoft*
BlueMAX/386MAX 6.0	*Qualitas*
vs	
DESQview	*Quarterdeck*
QEMM 6.0	*Quarterdeck*

May the best team win!

Mark Scott
Readmar Systems
London

DR DOS problem?

Sir,

When a customer of ours recently upgraded his PC to DR DOS V6.0, the application program, written in Clipper Summer '87, started to crash out reporting DOS error 0. Substituting MS-DOS V5.0 as the operating system cured the problem. Other readers may benefit from our experience.

Ian Butterworth
QBS Ltd
London

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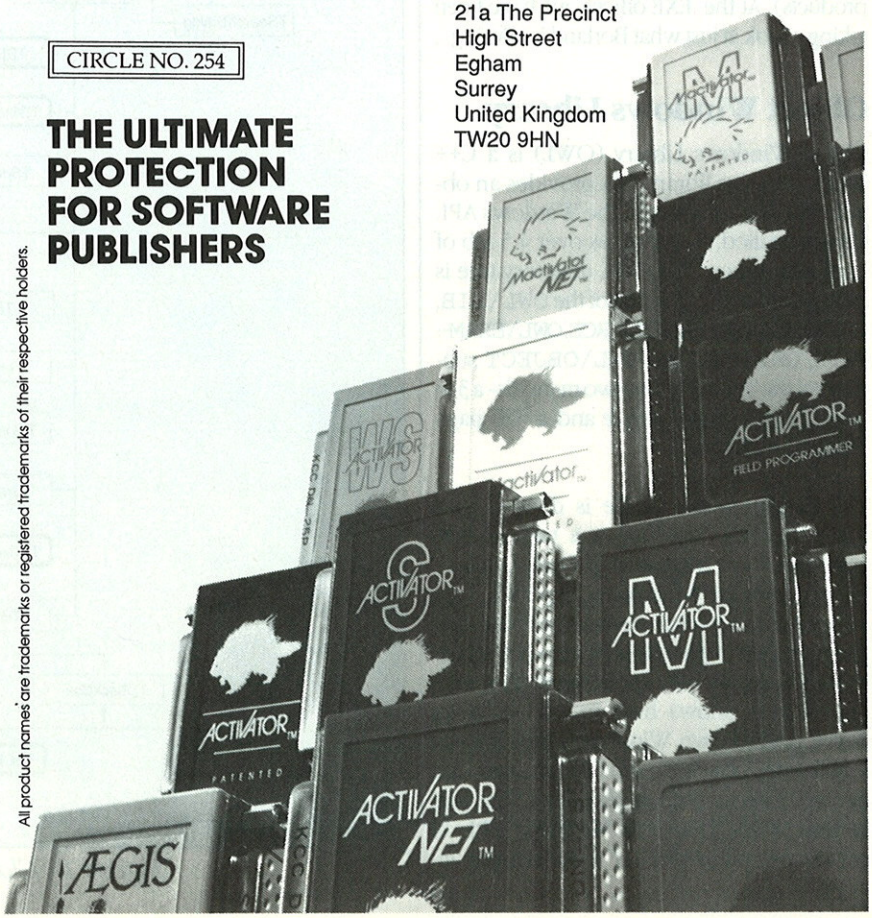

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The OWL, The Framework, His Vision and Her Workshop

Borland's ObjectWindows and TurboVision libraries for C++ have finally hit the streets, along with a new resource editor. Cliff Saran and Paul Kemp do the biz...

Borland is on the offensive again with the introduction of two new products - Borland Application Framework and Resource Workshop. The Application Framework package bundles C++ versions of the Object Windows and Turbo Vision libraries (previously only available for Turbo Pascal for Windows and Turbo Pascal V6.0 respectively) with the Borland C++ V2.0 compiler. Resource Workshops appears to be a new stand-in replacement for the ubiquitous Whitewater Resource Toolkit (which is currently included in all of Borland's compiler products). At the .EXE offices, we have been taking a look at just what Borland is offering...

Object Windows Library

Object Windows Library (OWL) is a C++ Windows class library that provides an object-oriented interface to the Windows API. Once installed, it consumes over 4.5 Mb of hard disk space. The OWL directory tree is straightforward, consisting of the `OWL\LIB`, `OWL\INCLUDE`, `OWL\SOURCE`, `OWL\EXAMPLES`, `OWL\DOC` and `OWL\OBJECT` subdirectories. There are also two manuals - a 336 page *Programmer's Guide* and a 570 page *Reference Manual.*

The Programmer's Guide is divided into three sections. The first is a tutorial that covers the implementation of a simple drawing program for Windows using OWL. The information is well presented and provides programmers with a step by step approach to building an OWL application. The second section shows how to use OWL to develop your own Windows applications. It illustrates how the main OWL classes can be used in your own applications. The last section is all about the Windows API. It covers several aspects of programming in

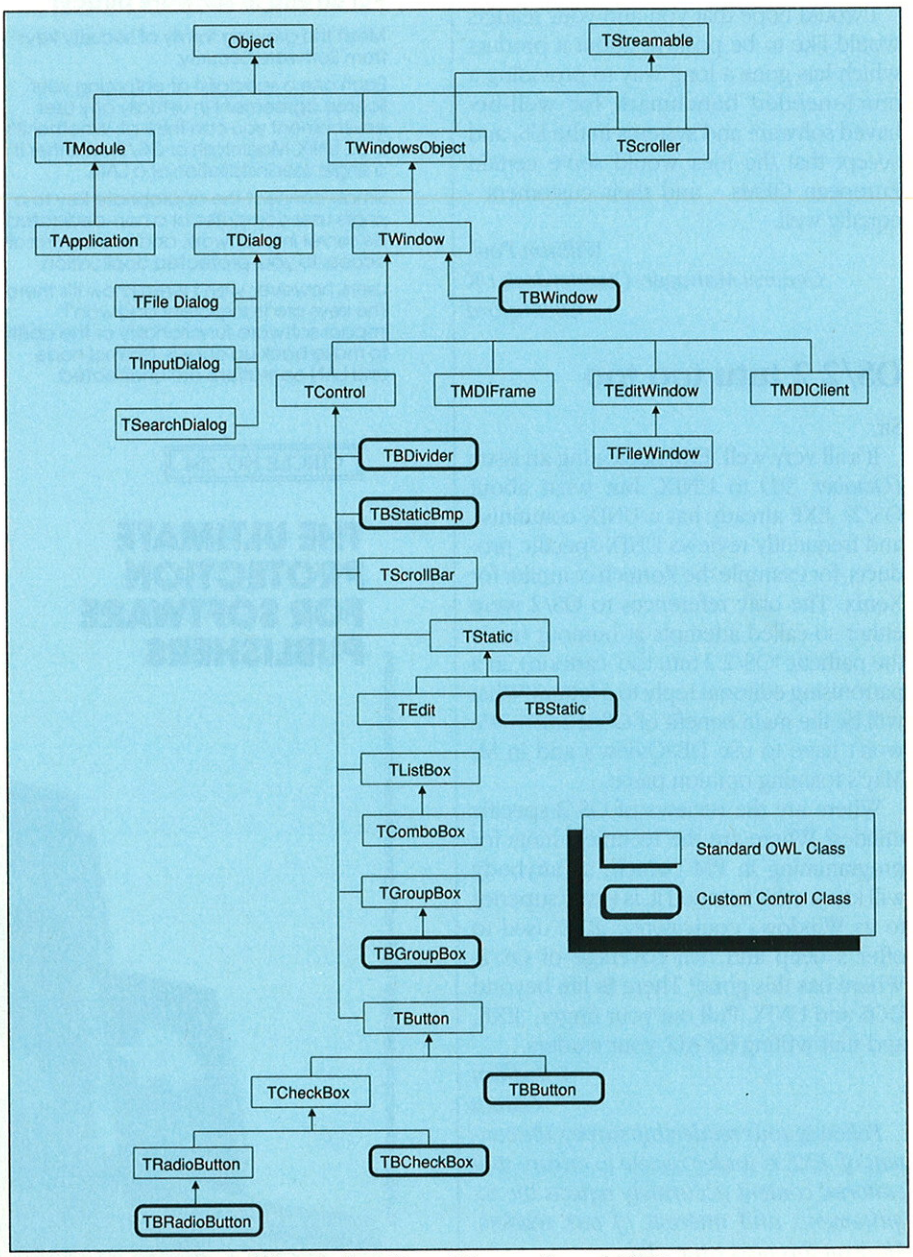


Figure 1 - Class Hierarchy of OWL

```
...

// Application class
class MyApp : public TApplication
{
public:
  MyApp (LPSTR AName, HANDLE hInstance,
          HANDLE hPrevInstance,
          LPSTR lpCmdLine, int nCmdShow);
  virtual void InitMainWindow ();
};

// Main Window class
class MyWin : public TWindow
{
public:
  MyWin (PTWindowsObject AParent, LPSTR ATitle);
  // SetDate() is called when the user clicks on
  //    the SET DATE menu option.
  virtual void SetDate (RTMessage Msg) =
                        [CM_FIRST +
                          SET_DATE_MENU];
  // ExitApp() is called when the user selects the
  //    Exit option.
  virtual void ExitApp (RTMessage Msg) =
                                [CM_FIRST +
                                  EXIT_MENU];
};

// Date Dialog box class
class TDateBox : public TDialog
{
public:
  PTButton Exit_Button;
  PTComboBox  DayBox;
  PTComboBox  DateBox;
  PTComboBox  MonthBox;
  PTComboBox  YearBox;
  TDateBox (PTWindowsObject AParent, LPSTR AName);
  // Event handler for EXIT button.
  virtual void ExitDate (RTMessage Msg) =
                              [ID_FIRST +
                                EXIT_DATE];
  virtual void SetupWindow();
};

// Set Date menu option - Event Handler
void MyWin::SetDate (RTMessage Msg)
{
  TDateBox *SetDateBox;

  SetDateBox = new TDateBox (this,
                             "DATE_BOX");
  // Execute modal dialog box.
  SetDateBox->Execute();
}


...


int PASCAL WinMain (HANDLE hInstance,
                    HANDLE hPrevInstance,
                    LPSTR lpCmdLine,
                        int nCmdShow)
{
  MyApp DateApp ("OWL", hInstance, hPrevIn-
stance,
                  lpCmdLine, nCmdShow);
  DateApp.Run();
  return DateApp.Status;
}
```

Figure 2 : Outline of An OWL Application

Windows including information on memory management, dynamic data exchange and using the Windows GDI. The Programmer's Guide looks at most features of OWL and it is worthwhile browsing through. All of the example programs are included on disk and these provide an invaluable template on which to build your own applications.

Unlike the Programmer's Guide, the Reference Manual is not as useful as it first appears. Less than a quarter of this manual is dedicated to OWL - the rest of it covers the Windows API. There is no cross-referencing so, whenever you need to look-up a method, you have to know which class defines it. Fortunately, Borland has provided an online help system. There are two versions - the first is DOS-based and is activated using a hot-key while the other is compatible with the Windows Help system.

There are four versions of the Object Windows Library - one for each memory model (small, medium, large) and one for the OWL Dynamic Link library (DLL). The easiest way to develop an application is to use Borland's **BCX** IDE (the standard **BC** IDE quickly runs out of memory when compiling OWL applications). Unlike Turbo Pascal For Windows, the IDE is not integrated within Windows so the testing and debugging of OWL applications in C++ can be extremely tedious. In order to link correctly, OWL requires the `CLASSLIB` library which can be found in the `BORLANDC\CLASSLIB\LIB` subdirectory. Once the *INCLUDE* and *LIB* search paths have been set, and BCX has been told to generate Windows executables using the correct memory model, it is only necessary to add the appropriate `CLASSLIB` and `OWL` libraries and a resource file to the project group. All that's needed now is a little application code...

First you need to `#include <owl.h>` - it is a good idea to select the *pre-compiled header* option in the BCX *Compiler Options* menu as this will greatly reduce future compilation times. A basic framework for any application requires the following. First there must be a class derived from `TApplication (MyApplication)` with a method defined for `InitMainWindow()` (see Figure 1 for OWL class hierarchy). Then there should be a class derived from `TWindow (MyWindow)` with a constructor. Finally the `WinMain` function should be written.

`TWindow` is a class that defines the features of a generic window. An application needs to derive a class from TWindow (eg `MyWindow`) in order to add functionality to it. If `MyWindow` is the Main Window, it must be created at the start of the application. This is achieved in the `InitMainWindow()` method by calling the `MyWindow::MyWindow()` constructor. A Windows application's primary task is to respond to messages that it receives from Windows. OWL essentially takes care of this event-handling, although there must be a way to 'start the ball rolling'. This is achieved in `WinMain` by invoking the `MyApplication.Run` method.

Borland has attempted to simplify the way in which an application responds to Windows messages. By modifying the C++ language, Borland has come up with the Dynamic Dispatch Virtual Table mechanism (see separate box - *The DDVT Revealed*) which automatically routes these messages to special, user-defined event-handling methods. The most obvious difference between these methods and standard C++ methods, is in the way in which they are declared. Borland C++ uses the Message ID to invoke the correct event handler. Thus when declaring an event-handling method, it is necessary to specify a Message ID. In Figure 2, `MyWindow` declares an event-handler for both options in the File menu.

In addition to the `TWindow` class, OWL provides the programmer with a `TDialog`, generic dialog box class. Like `TWindow`, in order to do something useful, you must derive a class from `TDialog`. Fortunately, Borland has built three particularly useful dialog boxes into OWL - the `TFileDialog`, `TInputDialog` and `TSearchDialog` classes. There is a subtle relationship between a dialog box

	Borland Resource Workshop	*Whitewater Resource Toolkit*	*Microsoft SDK*
Dialog Editor	Y	Y	Y
Bitmap Editor	Y	Y	Y
Menu Editor	Y	Y	N
Accel Table Editor	Y	Y	N
String Table Editor	Y	Y	Y
Font Editor	Y	N	Y
.RC File Editor	Y	N	N
User Defined Resources	Y	N	N
Integrated Environment	Y	Y	N
Custom Controls Library	Y	N	N
Extensible Tools Pallet	Y	N	N

Figure 3 - Comparison of resource creation tools

resource and the `TDialog` class - you can use an editor to create dialog boxes to your heart's content, but if you then need a programming interface with OWL (eg to add functionality to your dialog box) then you have to derive a class from `TDialog`, containing all the controls (eg `TButton` and `TComboBox`) that determine what action the application should take.

Although the Object Windows Library provides an object-oriented interface to Windows, it is certainly not easy to use. Borland has built the library in such a way that, when writing an OWL application, it is necessary to `#include` several header files and, at least two libraries must be linked (although the libraries can be dynamically linked). For instance, each control in a dialog box (eg the `TButton` and `TCheckBox` classes) has its own header file. It would have been far better if a programmer only had to include `OWL.H` and then link with the OWL library. There is much controversy over DDVTs, but I feel that Borland is justified in their use, as DDVTs enable you to handle all 65535 possible Windows messages in a consistent way (don't try this as it will make your compiler very ill). However, unlike the Zinc Interface Library or CommonView, OWL is a totally proprietary Windows class library and if you plan to use it, you'll be locked into the Borland C++ compiler family.

Resource Workshop

The creation and maintenance of resources is fundamental to writing Windows applications. A resource is read-only data that is stored in an application or dynamic link library (DLL), and is loaded from disk on demand by Windows. Typically, resources are data (binary and ASCII) representing such things as dialog boxes, icons, menus, bitmaps, cursors and character strings. Although resource data is part of an application's .EXE file, they are not defined in the program's source code. Resource descriptions can be declared in a text file called a *Resource Script* (normally given a .RC file extension) which is subsequently compiled to produce a binary .RES file. This is then tacked on to the application's .EXE by a second invocation of the resource compiler. The resource script 'language' was devised by Microsoft and the resource compiler is shipped with the Windows Software Development Kit (SDK). In addition to the resource compiler, the Microsoft SDK comes

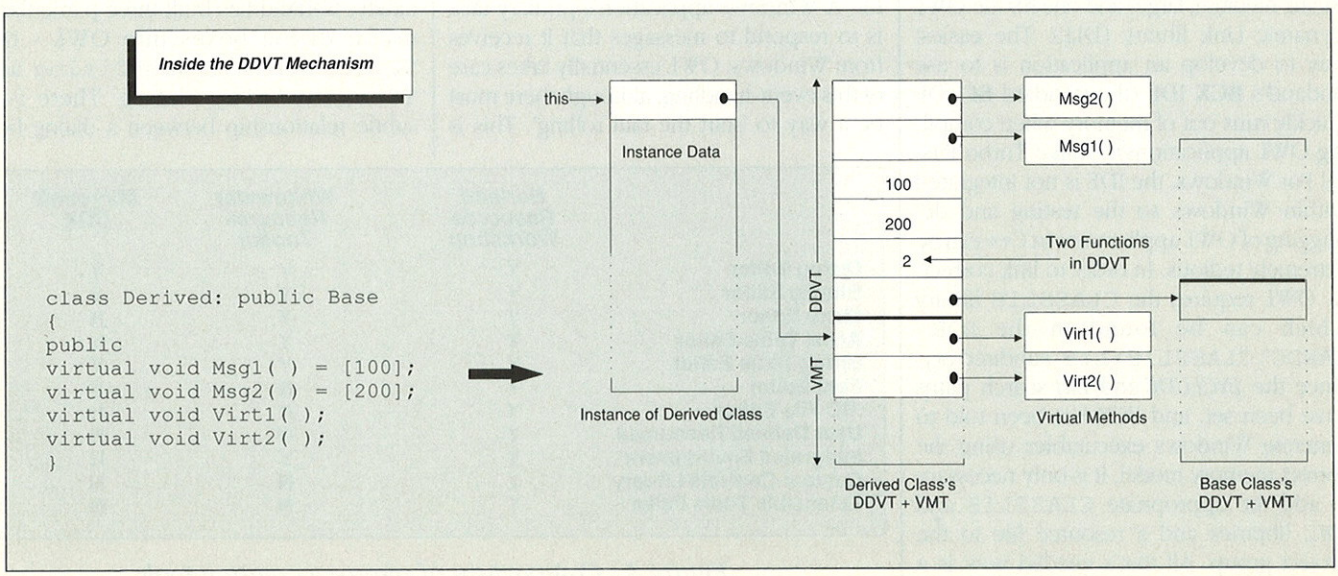
The DDVT Revealed

The Dynamic Dispatch Virtual Table (DDVT) mechanism is Borland's attempt at addressing a specific problem with Windows - ie how to provide virtual message handling methods for all of the possible messages that could ever be generated by a Windows application (see BYTE Sept 91 - '*Class Conflict*'). When a Virtual function is declared, its address is put into a special table called the Virtual Methods Table (VMT). When a Virtual function is invoked, this table is indexed to provide a pointer to the actual function to execute. If a virtual method was declared for each of the 65535 possible Windows messages, the VMT would occupy 256 KB (using Large Memory Model).

To overcome this, Borland has devised an ingenious method to add Virtual functions to a VMT in such a way that, in a derived class, only the virtual functions you declare in this class are put into the table - virtual functions inherited from the base class only appear in the base class's VMT. In the DDVT, an integer is associated with each virtual function - an event-driven system uses this integer to determine the actual message which the event-handler function will respond to.

The diagram below illustrates the layout of a typical DDVT. When an application generates a message, it must send the Message ID to a user-defined message dispatcher which searches through the DDVT in order to match this ID. If there is no match then the dispatcher must ascend the class hierarchy until the MessageID is found. Since there is a direct correlation between the position of the MessageID in the DDVT, and its corresponding virtual function pointer, once an ID has been matched the message dispatcher is able to invoke the correct event handler. This 'sledgehammer' approach is not as efficient as ordinary virtual mehtod calls. Borland has recognised this and, in OWL, the supplied message dispatcher is hard-coded in assembler.

Borland has no intention of proposing DDVTs to the ANSI X3J16 committee, which is currently working on a draft for the proposed ANSI C++ standard. However, it has been submitted to the Object Management Group (OMG is a collection of manufacturers attempting to set standards for the way in which objects are used and stored). Although DDVTs are a non-standard extension to the language which no other compiler supports, they do provide an elegant method to write event handlers. DDVTs may even be applied to object-oriented error handling. Unfortunately Borland has failed to support them fully - the virtual message dispatcher should be built into the language, instead of being relegated to an extension of OWL.



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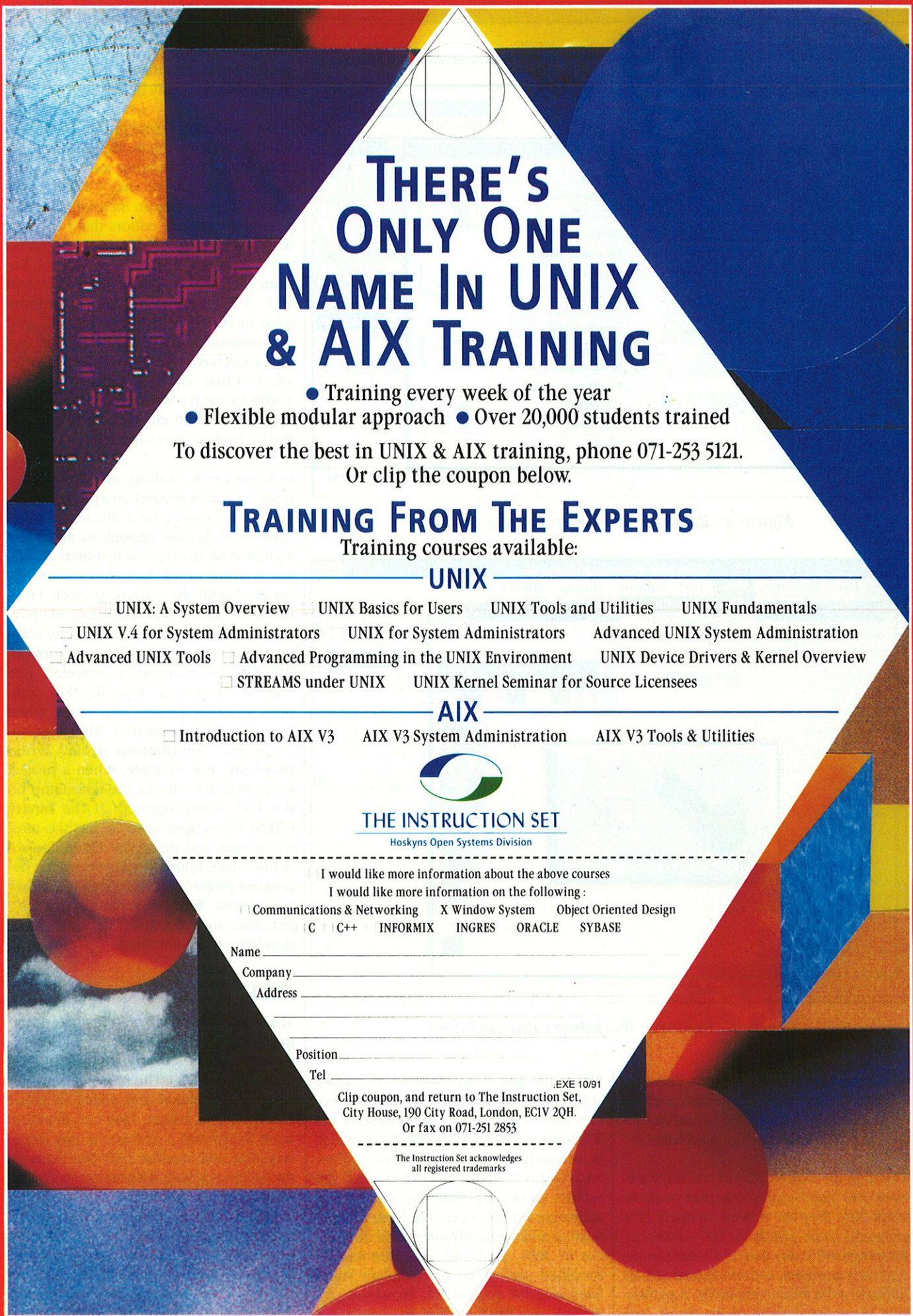

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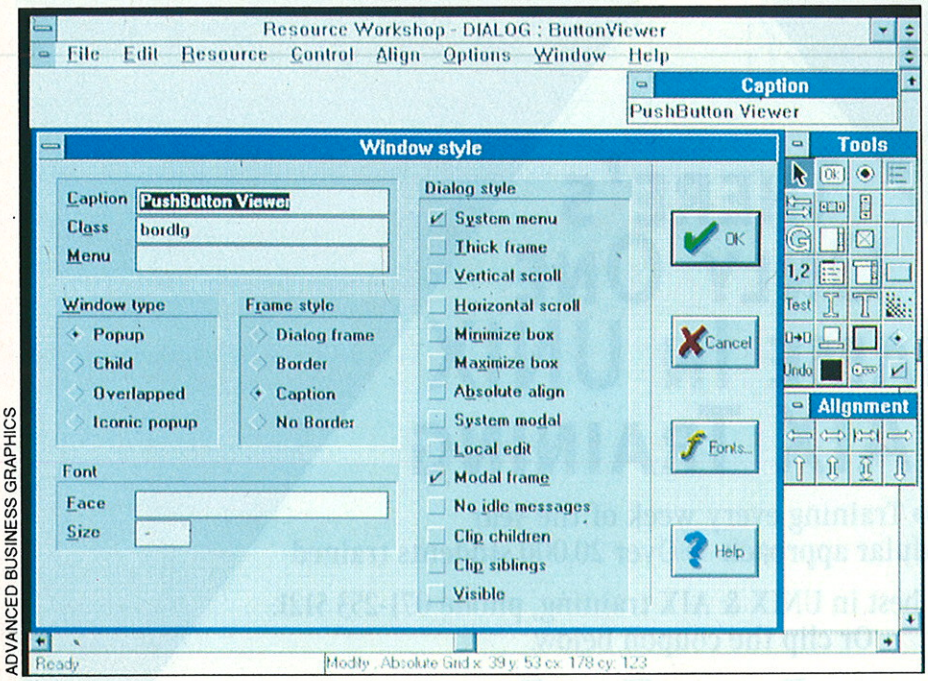

Figure 4 - Resource Workshop's Dialog Editor

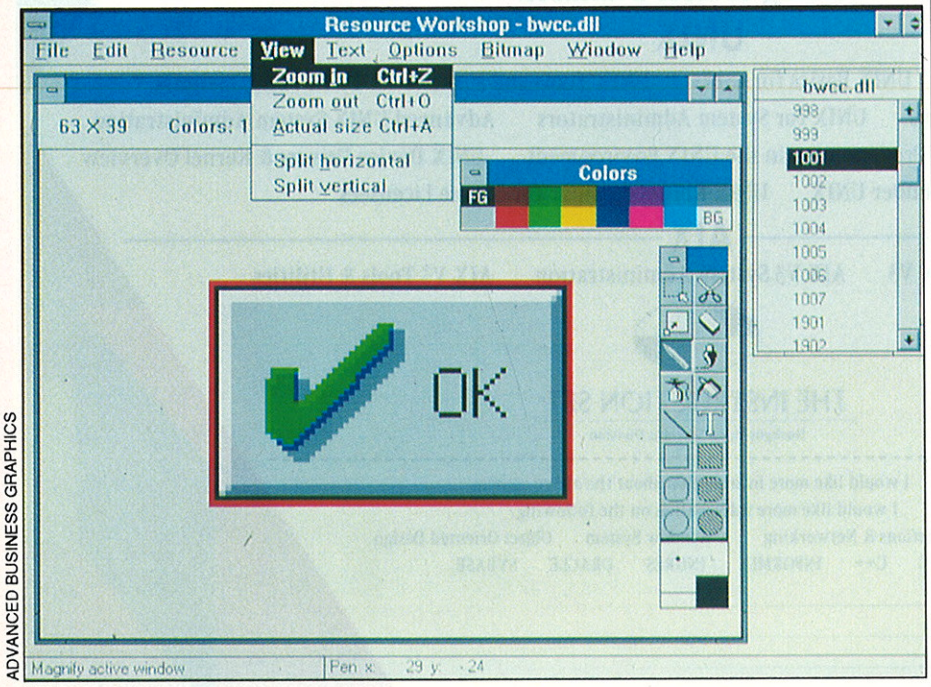

Figure 5 - Resource Workshop's Bitmap Editor

with a number of *Resource Editors*. These are Windows programs that help programmers to create dialog box, icon, bitmap and font resources in a more intuitive graphical manner.

Although the SDK editors are an improvement over 'hand coding' complex resource script files, they are viewed by many programmers to be primitive. The editors are not integrated in any way and some resources (such as menus and accelerator tables) still have to be written manually. A particularly frustrating feature of the dialog box editor is that it maintains a separate binary (.RES) file and is not capable of reading script files directly. Many of these deficiencies were addressed by the release of the Whitewater Resource Toolkit (WRT) which is currently shipped with Borland C++ and Turbo Pascal for Windows. All the editors (including ones for menus and accelerators) are accessible from a single toolbar and are tightly integrated. Resources in .RES, .EXE and .DLL files can be modified and saved or complete script files can be generated. However, although the WRT is able to generate a complete resource script (.RC) file, it is still incapable of reading in such a file - only binary resources may be loaded.

Enter Borland's homegrown Resource Workshop (RW) - by far the most sophisticated tool for creating and managing Windows resources that I have come across. It comprises an incremental compiler and a host of editors that can cope with any type of Windows resource. Figure 3 shows a brief comparison of Resource Workshop, WRT and the Microsoft SDK. RW's dialog and bitmap editors have toolboxes and colour palettes that are reminiscent of Visual Basic, and dialog boxes have the snazzy Borland look-and-feel that will be familiar to users of Turbo Pascal for Windows (see Figures 4 and 5). An additional disk containing 66 wacky icons is also supplied.

In Resource Workshop, an application's resources are managed on a project basis. This will normally be a .RC text file because it is flexible enough to allow the inclusion of any type of resource. A project window in RW lists all resources associated with the current project. From here, the appropriate editor is fired up by double clicking on the name of the component resource. By setting an option, RW will also maintain a compiled .RES form of the project. Typically, RW compiles an entire project only once, when the project file is created. After that, incremental compilation occurs when necessary. For example, when a project is opened, RW checks the timestamp on the files being opened. If the binary (.RES) file is up-to-date (ie has the most recent date and time), the file is opened without recompilation; otherwise, the dependant project files are compiled as they are opened. When working within a project, files are recompiled as soon as the developer finishes editing.

MRT

The most important feature that distinguishes RW from the Microsoft and Whitewater tools is Multiple Representation Technology (MRT). This means that resources can be created and edited in either binary or text format. One can therefore work freely with a resource in any representation and translate between them on the fly. For example, it is possible to decompile resources in a .EXE file, modify a dialog box script in text mode, and then save it back to the executable. Even bitmaps can be edited as ASCII files! MRT puts Resource Workshop streets ahead of the competition because it can load and save resources in any format. Unlike the Microsoft SDK dialog editor, RW can also cope with the inclu-

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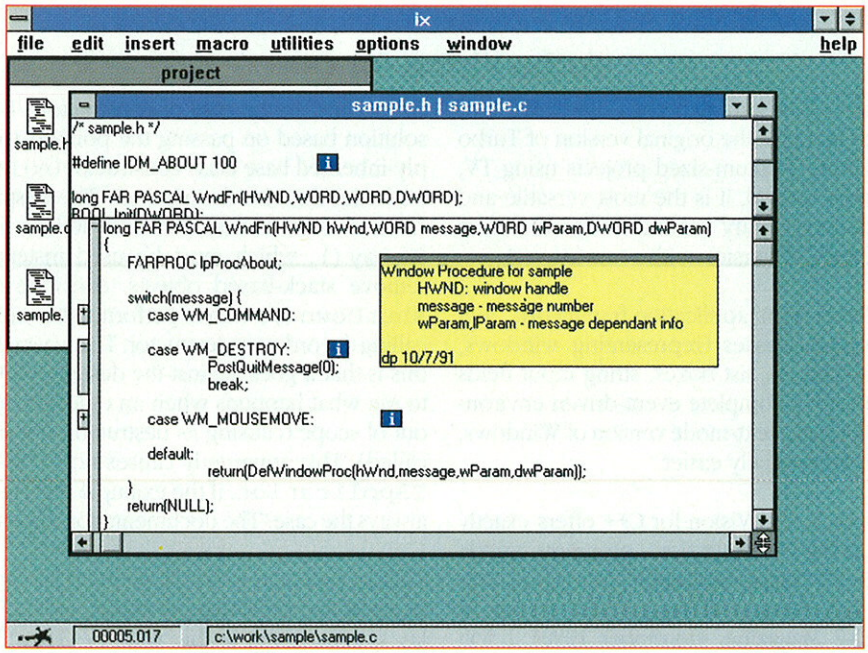
positive's ix Editor for Windows has all the standard features you'd expect from a professional editor and then some!



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sion of standard header files (with comments, `structs` and `typedefs`) rather than requiring a special 'clean' header containing only `#define` statements and no comments.

There are, however, just a couple of areas that I think could be improved. There is no warning of duplicate control IDs in header files and no facility to automatically generate unique IDs for new controls. In addition, the menu and accelerator editors are a little clumsy to use and should be better integrated. Resource Workshop is still the best tool of its kind on the market and should prove an asset to anyone involved in Windows development.

Custom controls

Bundled with Resource Workshop and OWL for C++ comes a set of classes called Borland Windows Custom Controls (BWCC). BWCC is a collection of custom controls and a custom dialog class that implement the 'chiselled steel' look and feel of Borland-style dialog boxes mentioned above. Mainly subclassed from the standard Windows controls, they offer a better-looking alternative and provide some extra styles, parent window notification messages and control messages. True to form, there is absolutely no documentation on these classes in either the OWL or RW manuals. All the information on how to use them has to be gleaned from a number of

Turbo Vision for C++

Best to declare my hand before starting. I am a die-hard fan of Turbo Pascal 6.0, which includes the original version of Turbo Vision. I have tackled three medium-sized projects using TV, and have found that, once sussed, it is the most versatile and powerful DOS text interface library around. I was therefore awaiting the release of the C++ version with some interest.

To backtrack: Turbo Vision is an 'application framework', ie it contains a set of interface classes (representing windows, frames, menus, dialogs, buttons, list boxes, string input fields etc) which combine to form a complete event-driven environment. It is a bit like working in a text-mode version of Windows, except programming is substantially easier.

As far as I could discover, Turbo Vision for C++ offers exactly the same functionality as the Pascal version - programs written in either system are visually indistinguishable. Since functionality and appearance was covered in our original review of Turbo Pascal V6.0 (.EXE Magazine, December 1990), I will concentrate on the differences between the two implementations. The comparison is based on my experience of writing the Windows MineSweeper game in Turbo Pascal, then porting the code to C++.

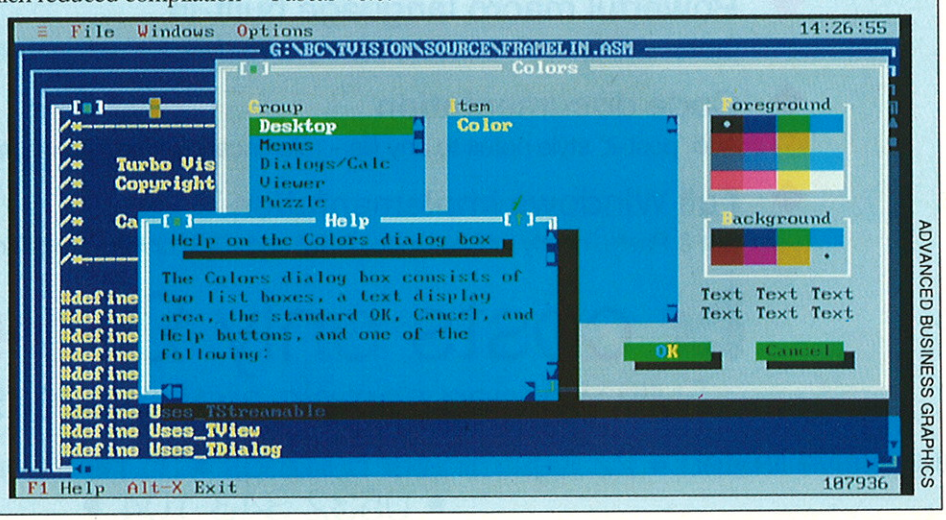
And here's the first difference: on the 286 Compaq machine I was using Turbo Pascal compiled my two-module program in 13 seconds, producing a 47 KB executable. Turbo C++ took *195 seconds* and produced a 129 KB .EXE file. Why the difference? Well, the extra time is caused by having to compile around 5000 lines of .H headers containing TV class definitions. Turbo Pascal's Units contain the equivalent information in a binary, precompiled form - hence the extra speed. *Borland* C++ offers a similar ability to precompile headers, which reduced compilation time to around 25 seconds (on a 20 MHz 386 machine, running the protected mode compiler and heavy disk caching). For this reason, I cannot recommend *Turbo* C++ with Turbo Vision. The difference in size of executables is, I am told, caused by Turbo Pascal's 'smart' linker, which leaves out unused methods.

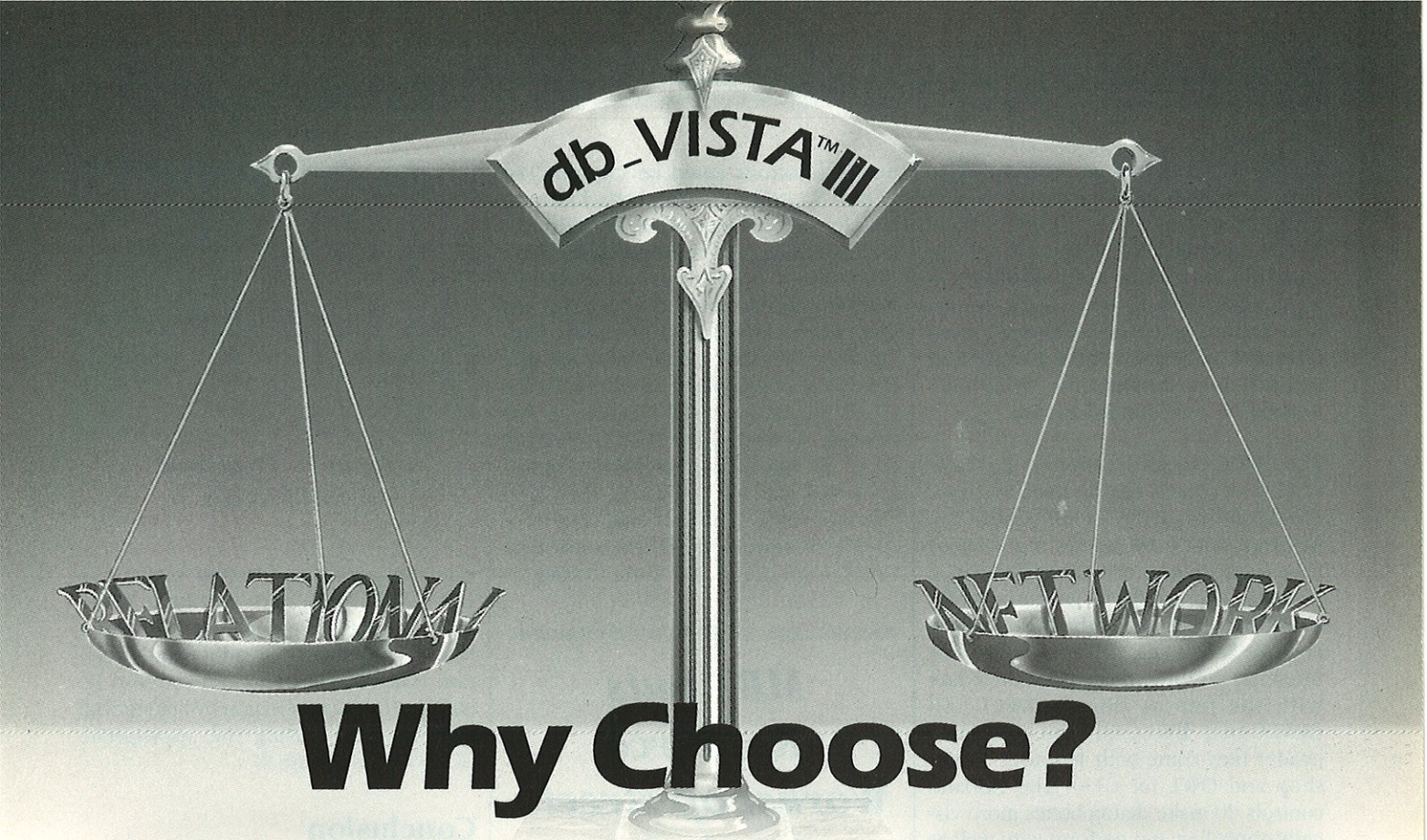
Another consequence of porting the Turbo Pascal design to C++ is problems with Turbo Vision's constructors and destructors. Turbo Pascal's constructors & destructors are able to call the virtual methods of descendant classes. C++'s can't. In the case of constructors, Borland has devised a solution based on passing the pointers to methods to a multiply-inherited base class constructor (no room to explain here - it's better than it's description). The destructor solution is less clean. For each class, Borland defines a static method `destroy()`, which must be used instead of `delete()` to remove stack-based objects. `destroy()` calls a method `shutDown()`, which performs the extra tidying up before calling the ordinary destructor. The reason I have a problem with this is that it goes against the design of C++. It is also not clear to me what happens when an object created in the stack goes out of scope (causing its destructor, not `shutDown()`, to be called). This apparently causes no trouble with derivatives of `TApplication`, if the example text is to be believed - is this always the case? The documentation appears to be silent on this.

The documentation is also silent on the fact that programs must be compiled large memory model, and that VROOMM (the overlay system) is not usable with TV. There is no online help for TV. These last two sould be fixed with the forthcoming V3.0 of Borland C++. Things which are better with TV C++: the Editor and File selection objects have become fully documented, instead of secrets that you stumble upon in the TV directory; the syntax for construction of menus and status lines has been cleaned up by overloaded + operator, and hurrah! Borland C++ with Application Frameworks includes source code for TV.

This summary of TV for C++ may seem very negative. It shouldn't be read as such - this is a strong product, but it does have a few rough edges which aren't in the Pascal version. For gush, see the original piece. If you need Turbo Vision but not C++, all other things being equal, you should prefer Turbo Pascal V6.0.

Will Watts.





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Relational Query and report writer	✓	
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CIRCLE NO. 257

lengthy README files on the distribution disks. It seems incredible that such an interesting component of the ObjectWindows library managed to escape proper documentation - Borland really should get its act together about this sort of thing. Instructions and examples (both C++ and Pascal) on how to create your own custom controls and add them to Resource Workshop's toolbox are also supplied on disk.

The BWCC classes are listed in Figure 6. OWL C++ objects can be used to create these controls on the fly, or controls can be given BWCC (Windows registration) class names in resource script files (coded manually or created with Resource Workshop). The code to handle these custom controls is in a DLL (BWCC.DLL) so that programs wishing to use them must link with the import library BWCC.LIB (BWCC.DLL, BWCC.LIB and associated header files come with Resource Workshop and OWL for C++). The Borland controls do make dialog boxes more visually appealing and perform very well as a result of 'turbo-painting'. The custom dialog class (BORDLG) not only paints the window background but actually optimises drawing itself. This is achieved by eliminating unnecessary static control windows, keeping its own private list of controls within a dialog, and painting those controls itself.

Bitmapped buttons

A feature I found particularly attractive was the ease with which user-defined bitmapped buttons could be created. The BORBTN control's default behaviour is to look for a set of bitmaps that represent the button in each of its three possible states - *Normal* (not pressed, no input focus); *Pressed*(pressed, input focus); and Focused (not pressed, input focus). The key to finding these bitmaps (whether they are in a linked DLL or part of the executable) is the ID of the button itself (Figure 7). For example, if one defines a BORBTN with an ID of 50 and then creates three bitmap resources with the following IDs: 1050 (Normal), 3050 (Pressed), and 5050 (Focused) - you have a brand new button type (VGA resolution). No extra coding is necessary - the bitmaps are switched automatically at run-time by BORBTN's default window proc in response to the user's mouse clicks etc. If the bitmaps cannot be found, a standard button is displayed with the button text. When creating user-defined buttons, I found it useful to copy templates from the predefined button bitmaps in BWCC.DLL itself, since Resource Workshop can extract resources in a DLL (see Figure 5). Borland's own bitmapped buttons (OK, Cancel, Help etc) can also be included in any application by linking with BWCC.LIB and using the appropriate BORBTN IDs (Figure 8).

MRT puts Resource Workshop streets ahead of the competition

Windows Registration Class	OWL for C++ Class Name	Description
BORDLG	n/a	Class name specified in resource script file. Provides patterned background on VGA displays. Implements 'turbo-painting' of custom controls.
BORBTN	TBButton	Bitmapped push buttons
BORBTN	TBStaticBmp	'Splash panel' (for displaying bitmaps that do not interact with the user)
BORCHECK	TBCheckBox	Better-looking check boxes
BORRADIO	TBRadioButton	Better-looking radio buttons
BORSHADE	TBDivider	Dip and bump dividers on Borland dialog boxes
BORSHADE	TBGroupBox	Gray 'chiselled steel' inset panel
BORSTATIC	TBStatic	Static text on a gray background

Figure 6 - BWCC classes

	VGA resolution	EGA resolution
Normal	ButtonID + 1000	ButtonID + 2000
Pressed	ButtonID + 3000	ButtonID + 4000
Focused	ButtonID + 5000	ButtonID + 6000

Figure 7 - BORBTN bitmap ID numbering scheme

ButtonID	Button text
1	OK
2	Cancel
3	Abort
4	Retry
5	Ignore
6	Yes
7	No
998	Help
999	(Blank)

Figure 8 - Predefined BORBTN IDs

Conclusion

The Application Framework is simply offering envious C++ programmers with tools that their Turbo Pascal colleagues have had for some time. Turbo Vision remains a great product, although it seems to have lost a little of the elegance which made its Turbo Pascal cousin so special. With OWL, a programmer must overcome several minor hurdles that make it difficult to use. However, once you have succumbed to the programming practices that OWL imposes on an application's design, you'll probably find that it's quite effective. The Resource Workshop is, undeniably, the best Resource Editor we have yet seen. It is easy to use and the Custom Controls really make a big difference to the 'look and feel' of Windows applications. With both Application Framework and Resource Workshop, there's room for improvement. Hopefully, the next release of Borland C++ (V3.0 will have a Windows IDE) will remove most of these annoying quirks, and we should see a product that Microsoft and Zortech will find hard to match.

EXE

ObjectWindows and Turbo Vision for C++ are priced at £49.95 and £39.95 respectively. The source code for each library is sold separately and costs £39.95.

Resource Workshop costs £29.95 (although it will be included in a future release of Borland C++). Application Framework costs £399.95. Borland can be contacted on 0734 321150.

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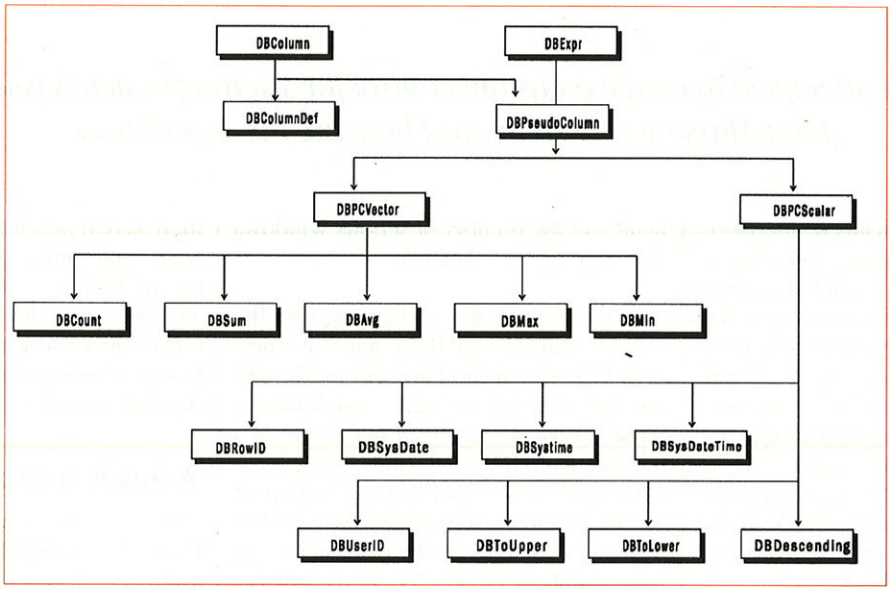

A sample from the CommonBase class hierarchies

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CIRCLE NO. 258

Developing a Visual Basic Custom Control

Few have attempted to create a custom control for Microsoft's new Visual Basic. John Marsh is one such, and here are his experiences.

Before getting into a detailed discussion about developing custom controls for Microsoft Visual Basic, I think I'd better declare my background and interest. At Bits Per Second, which I and two colleagues founded in 1982, we have worked on technical projects of all kinds. We have used many different programming languages, but mainly 8086 Assembler and C (more recently C++). Like others of our kind, we have tended to scorn Basic, while at the same time acquiring an intuitive fluency in its syntax - it's very insidious.

Our Windows experience began in 1989 when we started the development of Graphics Server, a graphing and charting library with DLL and DDE interfaces, based on dGE, our graphics add-on for the dBASE family. We soon came to two important realisations - programming Windows is difficult and the number of serious Windows developers is very limited.

Microsoft says all this is changing with the introduction of Visual Basic, which it claims is 'powerful, graphical and extensible' and 'the fast, easy way to create real Windows applications'. Certainly, Visual Basic is a fully integrated Windows development environment which makes the creation of simple Windows applications easy, and its low price will undoubtedly encourage large numbers of developers to start developing Windows applications. But can it be regarded as a serious developer's tool? Can real Windows applications really be developed using Visual Basic?

The key is extensibility. Without extensibility Visual Basic would be relegated to the status of a rather gimmicky toy, but with it there is real potential - DDE, communications, SQL links, graphing and charting etc all become possible. And it is in the area of extensibility that Microsoft (or possibly Cooper Software, which is credited as having developed certain key parts of the product) has shown some real ingenuity.

```
// A Custom Control's control procedure is
// similar to a Windows application's
// WndProc, except that in addition to
// standard Windows messages it also receives
// messages from Visual Basic itself. An
// extra parameter, HCTL, provides the
// handle of the custom control instance
// to which the message is addressed.

LONG _export CustCtlProc
(
    HCTL        hctl;
    HWND        hwnd;
    USHORT      msg;
    USHORT      wp;
    LONG        lp;
)
{
// FAR pointer to control instance
  PCUSTINST pCustInst = NULL;

  switch( msg) { // switch on message type
    case WM_NCCREATE:
      // create control instance here
      break;

    case WM_NCDESTROY:
      // destroy control instance here
      break;

    case VBM_GETPROPERTY:
      // get pointer to control instance
      pCustInst = (PCUSTINST)
                  VBDerefControl( hctl);
      // switch on property index
      switch( wp) {
        // get integer property value
        case IPROP_CUST_SHORT:
          *(( SHORT FAR *) lp) =
              GetPropVal( pCustInst, ....);
          break;
      }
      return 0;    // return Ok

    case VBM_SETPROPERTY: {
      ERR result = 0;
      // get control instance
      pCustInst = (PCUSTINST)
                  VBDerefControl( hctl);
      // switch on property index
      switch( wp) {
        // set integer property value
        case IPROP_CUST_SHORT:
          result = SetPropVal(pCustInst,
                      (SHORT) lp, ....);
          break;
      }
      // return error message or Ok
      return ( result ?
        VBSetErrorMessage( result, BADVAL)
                                    : 0);
    }
  }
  // default message processing
  return VBDefControlProc( hctl, hwnd,
                      msg, wp, lp);
}
```

Figure 1 - Custom Control control procedure

What is a Custom Control?

There are two ways of extending Visual Basic - by calling DLLs and by loading custom controls. The DLL (Dynamic Link Library) has become the traditional method for extending the functionality of a Windows application. Many Windows applications have such a facility - Excel, Superbase, SQLWindows and Actor for example. Superbase's recently announced SQL capability is provided via a DLL. It is how our own Graphics Server is typically used.

Visual Basic can call DLLs very easily. For example, to call the Windows function `IsZoomed` you simply declare it and then call it:

```
Declare Function IsZoomed Lib "User"
            (ByVal hWnd%) As Integer

If IsZoomed( hWnd) Then ...
```

This is all very well, but there are two problems. First, Visual Basic cannot check the validity of the DLL functions you use, nor the values you pass to them, so there is plenty of scope for error. Second, and more important, a DLL function can only be called at run time - you cannot take advantage of a DLL during Visual Basic's interactive design phase when you are creating your application's forms.

For example, suppose you wish to draw a graph on one of your forms. Which would you prefer - to declare and call (at run time)

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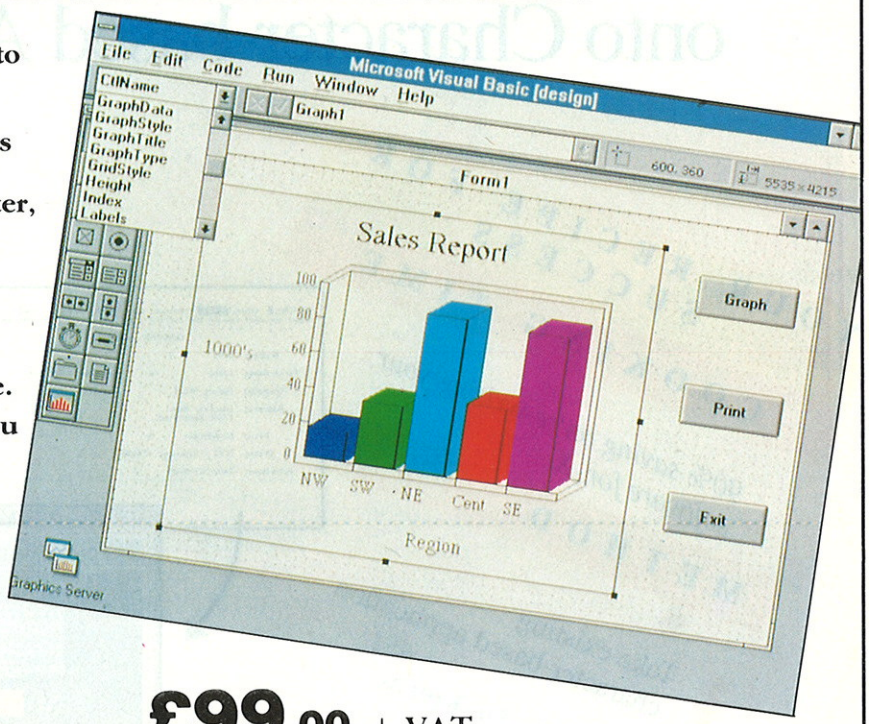

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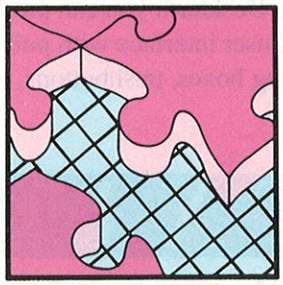

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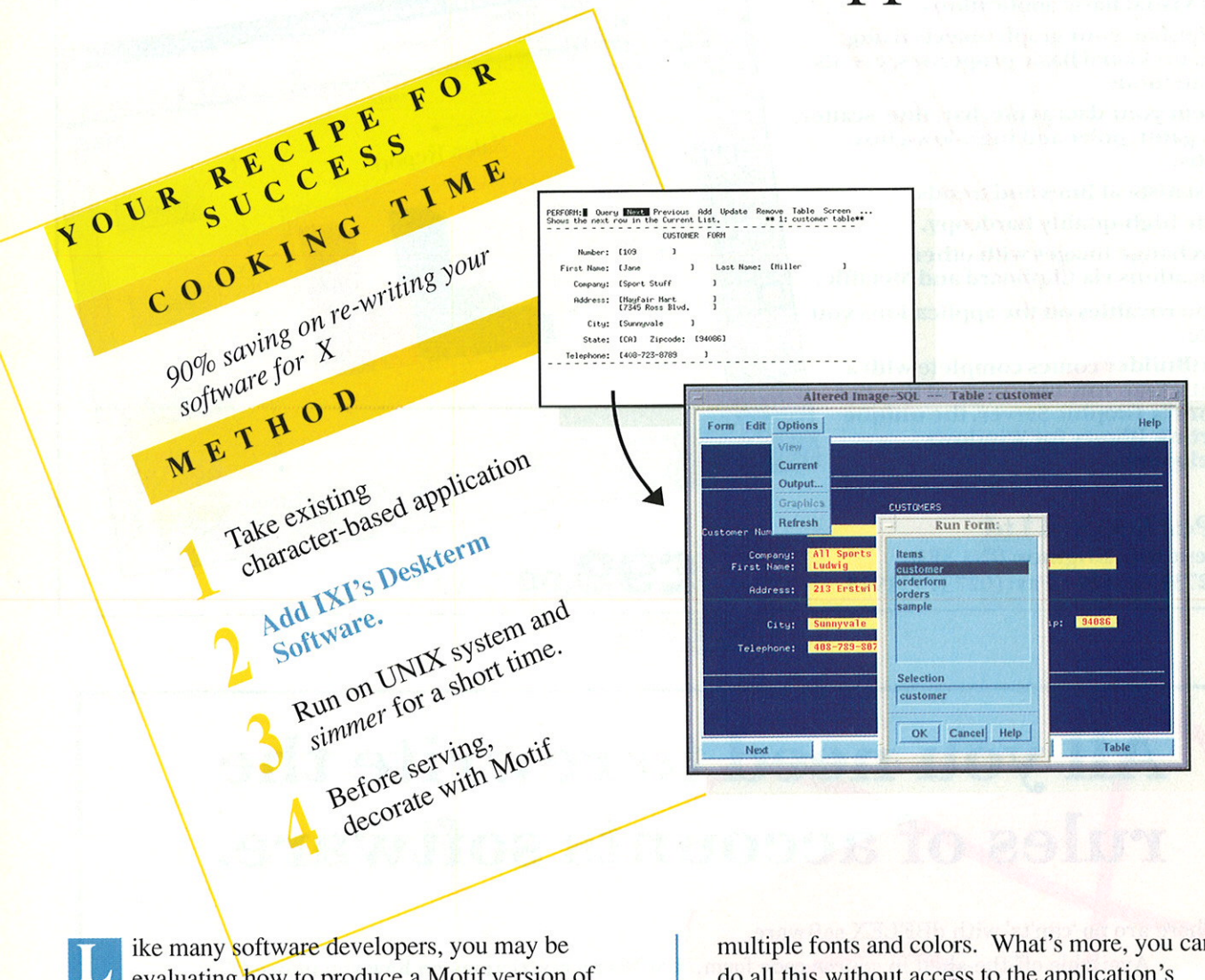

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CIRCLE NO. 261

a DLL function `DrawGraph` with a number of unchecked parameters, or to select a `Graph` object from the Visual Basic ToolBox, dynamically place it and size it on your form, choose from a wide range of style options, and then at run time display the graph with real data?

This is jumping ahead a little, but it is exactly what a custom control can do. A custom control is a DLL, but one with a special interface which allows it to be added to the ToolBox, and thus fully participate in the Visual Basic environment. To the user, a custom control is simply another object which he can use to build his application.

Visual Basic controls are manipulated via their 'properties' and respond to 'events'. Typical properties are `Left`, `Top`, `Height` and `Width` (which define the control's position and size on a form) and `DragIcon` and `DragMode` (which define how a control responds to drag-and-drop operations). Typical events are `Click`, `MouseDown` and `DragDrop`. Different controls have different properties and events to which they respond. You can set property values at both design time and run time, and you can write Basic code to respond to events, thus giving your program its actual functionality. A custom control can not only support standard properties and events, but also add its own. It is these which give a custom control its identity and purpose.

Because Visual Basic understands controls and their properties, it can ensure that they are used correctly and that property values are checked. Also, properties always have default values, with associated default behaviour. This means that a custom control, unlike a standard DLL, can be very easy to use, is inherently robust and can be used at both design time and run time - a much better proposition.

Where to start?

Microsoft has heavily publicised its Custom Control interface in order to promote Visual Basic as a serious development tool. As a result, potential users and developers are asking questions such as:

- Is it easy to write a custom control?

- How long does it take?

- Is it easy to debug?

As usual, these questions are of the 'Q: How long does it take to build a bridge?' 'A: It depends...' type. However, I must say that it's a lot easier to write a custom control than a complete Windows application (assuming that you are writing both in C) and that it may take between two days and two months to write one, dependent on its complexity. Debugging is easy if you are familiar with using CodeView for Windows.

Microsoft provides several sample custom controls in source form as part of its Control Development Kit (CDK), and if all you want to do is create a variant of one of its examples, then you could get by without fully understanding everything. This is especially so if you derive your control from one of the in-built, standard controls. This is known as 'subclassing', whereby you create a control which behaves identically to an existing control except where you override it by defining new behaviour. By doing this you can avoid a number of the more complicated issues such as painting and printing.

The Visual Basic CDK is well packaged and tested. In addition to the manual and example source code, it comes with a Windows help file with entries for all the VB API messages, functions etc. All the samples compile and run, and in the whole of my project I only found one genuine (and rather esoteric) bug, which in any case may have been fixed prior to release, since I was working with beta versions of both the CDK and Visual Basic itself. This inspires a lot of confidence, since it's not entirely typical of the software tools market-place.

In order to develop a custom control you need, in addition to the CDK, a language which can create DLLs. Naturally enough, Microsoft recommends C 6.0 or later, and all its examples are written in it. You also need the Windows Software Development Kit (SDK), primarily for WINDOWS.H and CodeView, plus the associated manuals, especially the reference manual for the Windows API functions, messages and data structures. It should be possible to use C++ rather than C, for example using Borland C++, which can certainly generate DLLs.

You will have a head start if you are a Windows C programmer. However, unless you are being very ambitious and are planning on creating a very sophisticated control, you will find it a lot easier than writing a Windows application. This is because Visual Basic takes care of a lot of the spadework.

Visual Basic Custom Control API

Function	Description
VBAllocPic	Allocate HPIC structure.
VBCreateHlstr	Allocate language string.
VBCreateHsz	Allocate HSZ string.
VBDefControlProc	Default message processing.
VBDerefControl	Get pointer to programmer-defined structure.
VBDerefHlstr	Get pointer to string data.
VBDerefHsz	Get pointer to string data.
VBDestroyHlstr	Remove language string.
VBDestroyHsz	Remove string.
VBDialogBoxParam	Create a pop-up dialog box.
VBDirtyForm	Indicate property change.
VBFireEvent	Execute event procedure.
VBFreePic	Decrement reference count and delete HPIC if count is zero.
VBGetAppTitle	Get application title.
VBGetControlHwnd	Get handle to window.
VBGetControlModel	Get model structure.
VBGetControlProperty	Get property value.
VBGetHInstance	Get handle to current instance of Visual Basic.
VBGetHlstrLen	Get string length.
VBGetHwndControl	Get handle to control.
VBGetMode	Determine whether in design, run, or break mode.
VBGetPic	Dereference picture data.
VBLockHsz	Get pointer to data and prevent string from moving.
VBPicFromCF	Get picture from Clipboard.
VBReadBasicFile	Read data file.
VBReadFormFile	Read property value from disk during a load.
VBRecreateControlHwnd	Destroy and recreate window, to enable new window styles.
VBRefPic	Increment reference count.
VBRegisterModel	Register a control class.
VBSendControlMsg	Send message to a control.
VBSetControlProperty	Set property value.
VBSetErrorMessage	Set text of next error message.
VBSetHlstr	Assign new string data.
VBSuperControlProc	Call parent class directly.
VBUnlockHsz	Unlock string address.
VBWriteBasicFile	Write to data file.
VBWriteFormFile	Write property value to disk during a save.
VBXPixelsToTwips	Convert X units to twips.
VBXTwipsToPixels	Convert X units to pixels.
VBYPixelsToTwips	Convert Y units to twips.
VBYTwipsToPixels	Convert Y units to pixels.

Figure 2 - Visual Basic Custom Control API

Writing a control

A custom control DLL (by convention called a .VBX to distinguish it from other types of DLL) consists of a 'model' data structure, which defines a number of the control's characteristics, together with two lists, one of the control's properties, the other of the events it supports. These properties and events can either be standard ones, in which case you have no more work to do, or your own unique properties and events for which you must write supporting code.

It also has a control procedure, very similar to a Windows applications' `WndProc`, which receives both standard Windows messages and extra messages from Visual Basic itself. The difference is that this control procedure is an extension of Visual Basic's own `WndProc`, and the Windows messages your control procedure receives have first been filtered by Visual Basic. If you choose not to process a message, you must pass it to Visual Basic's default control procedure by calling `VBDefControlProc` (see Figure 1).

Based on your 'model' structure, Visual Basic creates a window for you. It takes care of the placing and sizing of this window - you don't have to do any work. Your main task is to respond to the Visual Basic messages for getting and setting properties (`VBM_GETPROPERTY` and `VBM_SETPROPERTY`).

A key feature of a control's properties is that they can be used as normal variables within a Visual Basic program. This is why you receive messages for both getting and setting property values. If you wish, you can create read-only or even write-only properties. At design time, you receive these messages when the user is setting property values in the properties bar. At run time, you receive them when Basic code which references your properties is being executed.

To assist you, Microsoft provides a set of around 40 functions collectively known as the VB API. This is a subset of the functions which are used internally to support Visual Basic's standard controls (see Figure 2).

When a form containing your control is saved to disk, Visual Basic will by default save your control's properties for you in the form file. If you wish, however, you can save them (and load them) yourself by responding to the `VBM_SAVEPROPERTY` and `VBM_LOADPROPERTY` messages. You might do this when what you want to save is more complex than just the basic property value. For example, I used this technique to save two-dimensional data arrays.

```
// Data declarations:

// declare segData as a segment base
_segment segData;

// data based pointer
#define DBP _based( segData) *

// data based handle (pointer to a pointer)
#define DBH DBP DBP

// data based void handle
typedef VOID DBH BHVOID;

typedef struct tagDATA {
                // # data points
    SHORT       Points;
                // array of real data
    REAL        fData[1];
    } DATA;

// handle to distance data
DATA    DBH bhDistance;

  |     |

// Allocate & initialise a local heap in
// global memory:

  hseg = GlobalAlloc( GHND, 8192);
  if ( !hseg)
      return FALSE;
  segData = (_segment) GlobalLock( hseg);
  LocalInit( segData, 16, (USHORT)
                          GlobalSize( hseg));

  |     |

// Routine to allocate memory in local heap:

BHVOID NEAR MemAlloc ( USHORT  cb )
{
  HANDLE  hTemp;
  _asm
  {
      push ds
      mov ds,segData
  }

  hTemp = LocalAlloc( LMEM_MOVEABLE |
                      LMEM_ZEROINIT, cb);

  _asm
  {
      pop ds
  }
  return (BHVOID) hTemp;
}

  |     |

// Use MemAlloc to allocate a data array
// in a local heap:
  bhDistance = (DATA DBH) MemAlloc(
      sizeof( DATA) + ( REAL) * (Points-1));

// Access a point in the data array:
  fDataVal = (*bhDistance)->fData[Point];
```

Figure 3 - Creating & managing instanced local heaps

Memory management is probably the most important technical issue you have to address in a custom control, as it is in any Windows program. You must remember that there may be many instances of your control active at the same time (in our case, there may be several graphs on one or more forms). You cannot predict the order in which you will receive messages, and therefore you cannot use static or global variables to hold information between messages. Your code may even be executed reëntrantly - eg you could call a Windows API function in your control which causes a message to be sent immediately to your own control procedure.

Visual Basic helps by providing the facility for you to create a data structure to hold all the 'instance information' of your control, typically its current property values. It reserves space for this structure internally, and guarantees it will not be used or corrupted by other control instances. Your first action on receipt of a message will normally be to retrieve the address of this data structure from Visual Basic so that you can process the message in the context of the correct instance of your control. To do this you call the API function `VBDerefControl` with the control handle (`HCTL`) passed with the message.

If your control needs to store a variable amount of data (as mine does for its graph data arrays) you will probably want to allocate memory on a local heap. You can't use the above-mentioned structure directly since it must be of fixed size. This is a problem, because in C you can normally have only one local heap for your entire DLL. However, there is a neat way around this. With the help of a little in-line assembler code, you can create and manage instanced local heaps ie. one per instance of your control. You can store the segment value of each local heap in your control's instance information and retrieve it when you want to access the variable-length data. If you are feeling adventurous, you can access your instanced local heaps using based pointers for better performance and smaller code size (please see Figure 3).

If you derive your control from a standard control, you may be able to use the standard control's ability to display and print itself in response to the `WM_PAINT` message. However, assuming this is not the case, you will need to get to grips with the Windows Graphical Device Interface (GDI). This is not that simple and requires a lot of study of the relevant sections of the Windows manuals. Avoid having to do this if you can!

I haven't talked much yet about events. In fact, it's very possible you won't need to write any special code to support events, but simply choose which of the standard events your control needs to support. By including a standard event in your list of supported events, you make that event available to the user. For example, if you include the `Click` event in your list, the user will be able to write an event procedure in Basic to respond to a mouse click on your control. It's as simple as that.

However, you might need to create unique events of your own. Suppose you were to write a spreadsheet control (an ambitious project!), you would need your own unique

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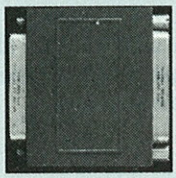
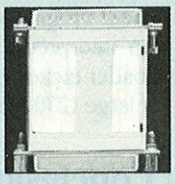
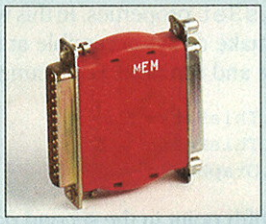

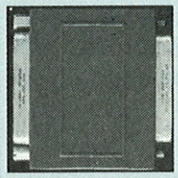
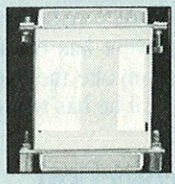

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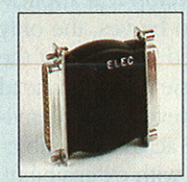

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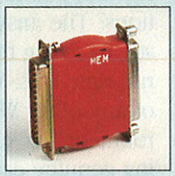

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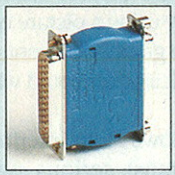

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EXE II 91

CIRCLE NO. 262

events to indicate things such as a change of focus from one cell to another. To implement an event of your own, you would add it to your event list, write the code to detect when it occurs (usually by trapping Windows messages), and then call the API function `VBFireEvent` to notify Visual Basic the event has occurred. Visual Basic will then invoke the user's Basic event procedure, if he has written one.

Protection

Two important issues for commercial software developers are how to protect against piracy and how to create a version of their software which demonstrates the power of their product without giving away too much.

A custom control will typically be purchased by a programmer who wants to build it into an application. If he wants to distribute that application he must also distribute the custom control, even if he has created a .EXE version of his application. Now, suppose the recipient of the application has a copy of Visual Basic, then what is to prevent him from using the custom control himself to create further applications? Microsoft has anticipated this and has provided a mechanism for the control to find out how it is being used. Microsoft recommends that the custom control vendor supplies two versions of his control, one for design use and one for run time use only. This latter version is the one the purchaser distributes with his applications.

In a similar fashion, a restricted, demonstration custom control could refuse to work in the run-time environment, and thus be useless to anyone attempting to build it into an application for distribution. We have used variants on these techniques to protect our own custom control.

Any criticisms?

I do have some detailed criticisms of Visual Basic and its Custom Control interface, although none of them are serious. Some will undoubtedly be addressed in later releases. Here are the problems I had to program around:

Property data types are somewhat restricted. Not all the Visual Basic data types are supported. For example, a property cannot be a double-precision floating point number.

A property can be an array, but only single dimension arrays are supported, and an array-type property cannot be accessed at design time. I found this a great pity, since graphing and charting is heavily oriented towards arrays of data (multiple points and data sets, arrays of colour and symbol information etc). My solution was to create arrays out of normal, non-array properties, and to access them through `ThisPoint` and `ThisSet` properties. In this way I was able to make arrays accessible at both design time and run time. For example:

```
graph1.ThisSet = 2
graph1.ThisPoint = 5
graph1.GraphData = 25.5
```

sets the fifth point in the second data set to 25.5. A little clumsy, but effective.

There is no facility to define your own methods (commands to non-OOP aficionados). This is a pity, but can mostly be overcome by using the getting or setting of a property instead to trigger some action.

There is no direct DDE support for custom controls. Whereas a standard control can act as either a client or a server in a DDE conversation, a custom control cannot, except via an intermediary. For example, our 'ChartBuilder' graph control can act as a DDE server only by using a picture control to forward a changed graph to a client - acceptable, but not a slick as one would wish.

There is no Windows Help interface. This is perhaps the most serious omission. Microsoft provides help for Visual Basic itself, including help on all its in-built controls' properties. But what about help for your control's unique properties and events? There is no facility for you to extend Visual Basic's help with your own. I overcame the problem by creating a 'Help' property. Any access to my Help property triggers Windows Help with my own help file (an example of using a property to implement a method).

A Windows application usually has an 'About Box', which it can use to display version number, author etc. No such facility is available to the custom control. With a commercial software product this is important for both support and copyright reasons, so I created a '`CtlVersion`' property which is a read-only string property containing version number and copyright notice.

Of Visual Basic itself, I would say that its printing is weak. The `PrintForm` method prints a bit-for-bit image of a form, thus wasting the potential resolution of the printer. I overcame this problem by providing an option to print graphs direct to the printer at the full resolution of the printer driver.

Its Z-ordering (the order in which it displays overlapped controls and thus which controls get clipped) is very strange - I still can't predict what it's going to do! This can create bizarre effects when you drag-and-drop or refresh overlapped controls at run time.

And finally, the. EXE file generation is ok, but of course everyone will want truly compiled programs. Right now what you get is an interpreted program with an EXE file loader tacked on the front, which requires a large (270 KB) DLL in order to run.

Conclusions

As I said at the beginning, long-term Assembler and C programmers are unlikely to show immediate enthusiasm for any new version of Basic. However, in the course of the last few months, we have had our prejudice converted into great enthusiasm, not least because of the way in which Microsoft has created an open architecture for Visual Basic via the Custom Control interface. It has given us the opportunity of making our programmable graphs and charts accessible to even the humblest programmer.

But can you use it to develop real applications? The answer has to be yes, the only stigma being the required presence of the run-time DLL. Visual Basic is streets ahead of any other Windows development environment I have yet come across in combining genuine ease of use with extensibility. A very effective way of developing a professional application would be to use Visual Basic for the framework of the application and its user interface, and to fill in the gaps with Custom Controls and DLLs. In this way none of the traditional arguments against Basic (lack of functionality and/or performance) are valid.

Visual Basic also introduces Object Oriented Programming concepts in such a gentle way that you won't necessarily realise you're going through a conversion process until you've been converted!

All in all, an excellent, open-architecture development tool - it's a winner!

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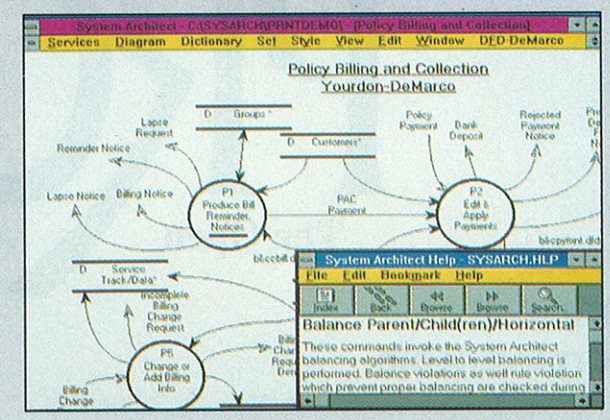

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Total rewrite?

JSB's Mike McCusker and Glenn Pittaway take a satirical look at the decisions which are forced on developers by the advent of GUIs, and explain the Deskterm approach.

The day started badly. I was late, ice on the points at Watford, and in my rush to answer the already ringing support 'phone, I knocked a half-filled cup of cold coffee over my keyboard. It was then I noticed that ominous yellow sticky note, right in the centre of my terminal. 'See me! C.J'.

'Look Norm, we must get GUI, and we must get it now!'. I was still in shock when CJ threw me the report, 'GUI Users Do It Better And Quicker'. Good idea for a bumper sticker I thought. 'My gut tells me GUIs are where it's at strategic-wise, and if WordPlexbASE 123++ isn't GUI in the next 6 months, we're dead meat, and I didn't get where I am today etc etc'.

The figures seemed to bear him out. The surveys showed that GUI users, even complete novices, were up to 35% more productive than their CUI counterparts, and that the work they produced was more accurate. Even fatigue and frustration levels were lower among GUI users.

I left CJ's office and began to consider the task.

Two years ago, WordPlexbASE 123++ represented the state of the art in CUI integrated office automation software. The ability to window complementary tools such as a spreadsheet, word processor and database had been revolutionary, and I was especially proud of my cascading menu system implementation which I'd sweat blood over. Getting to grips with character windowing had driven me to drink on more than one occasion, and what about all the performance problems I'd had with a 9600 bps line, refreshing the windows had taken an age. Swapping the keyboard focus between different windows had also been particularly tricky (how many unique hot-key combinations can you think of?)

I collected all the technical overviews, product descriptions and marketing hype together. After several hours of reading, pondering and head scratching I had discovered that there are only three major GUI environments: X-windows which is mainly UNIX, Microsoft Windows for MS-DOS, and Apple Macintosh.

What's In A GUI?

This looked promising, how different could they be? They all seemed to look the same.

i) They all use bit-mapped graphics, which means that the applications can use images such as icons, windows, menus, buttons, and scrollbars to allow the user to control the application and how it appears on the screen. That was a far cry from WordPlexbASE 123++, where the height of sophistication was the ability to swap windows using a short-cut like Alt-Ctrl-Shift-F1-a.

ii) They all allow the user to customise the environment, by changing the size of windows, moving them about the screen, and changing colours. Here WordPlexbASE 123++ was in a class of its own, the user could choose from a range of cursors (block or underline), and even configure the screen colours (these features only available on terminals with a 'Setup' option).

iii) They all offer a friendly and intuitive environment, the GUI using dialog boxes to interrogate the user, and help systems to inform him.

iv) They are totally and utterly incompatible! Oh dear.

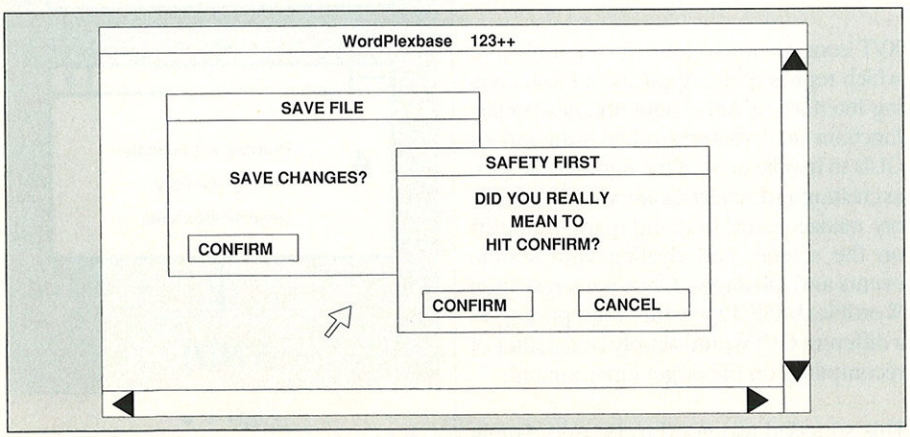


Figure 1 - The GUI environment

Eeny, Meeny...

The first decision was which GUI do we write to? CJ made his feelings clear, 'I didn't get where I am today by writing to just one GUI'. Unfortunately our programming resources, myself and a junior programmer also called Norman, ruled this out. Also this would put the support team (again myself and Norman) under a great deal of pressure. As for choosing a GUI, all the candidates had something in their favour.

The Apple Macintosh, introduced in 1984, seemed to be the most popular GUI, and is a stable and well tested system. It does however lack many of the features available in the newer systems.

Microsoft Windows has been widely adopted by users, and many of our competitors are busy porting their applications to the latest release, version 3.0. Sixty million PCs means that there is a fairly large potential market out there.

Being technically minded myself, I must admit to having found X Windows an attractive proposition. Although the market is small at the moment, and the hardware requirements are enormous, X has the advantage of having few applications to compete with WordPlexbASE 123++. One problem however concerns the raging battle over which 'Look and Feel' to adopt, Motif or Open Look.

It looked like I had four options:

i) Port the whole application for our chosen GUI.

ii) Port to a toolkit interface.

iii) Use conversion software to bolt a GUI onto my CUI.

iv) Start scanning 'Sits Vac' columns.

GUI Port

From the start this looked like the least attractive option.

The porting option would offer the best performance, we would be writing direct to the lowest level GUI functions. Also this approach would allow us to use the full functionality of the GUI. On the downside, I'd have to get up to speed on one or more GUIs, and all the courses and all the text books in the world wouldn't be of much help if the structure of WordPlexbASE 123++ wasn't appropriate for a GUI application.

At the heart of every major GUI application lies an event handling loop. The GUI presents the world as a series of events or messages: every time the user hits a key, or moves his mouse, an event is generated, this isn't necessarily the case for CUIs. This might not be good news for WordPlexbASE 123++, which consists of four main *while* loops linked by *goto* statements. (Figure 2).

By this time I knew what an icon was, but did WordPlexbASE 123++? This thought stopped me in my tracks. Assuming we could rebuild WordPlexbASE 123++ around a message loop, we still had all the visual aspects of the GUI to consider. How much work would be needed to make WordPlexbASE 123++ update scroll bars on its windows when the window was sized? How much code would we need to write to use the available fonts in our word processor or change 'Error! 1254/0xa2 see: section 10.3' into a dialog box saying 'Can't save changes'?

The possibilities both excited me and filled me with dread. This was not going to be a trivial task. To get WordPlexbASE 123++ to look as slick as the environment we'd chosen wouldn't involve so much porting it as rewriting it. So many of these concepts hadn't been relevant when I'd typed that very first `main()` all those years ago!

Swapping the keyboard focus between different windows had also been particularly tricky

Toolkit Port

Now this looked more like it. By this time I wasn't looking for miracle solutions, and this option presented fewer problems than a GUI port. To make best use of a graphical environment, we'd have to modify the code, but a toolkit port would allow us to deal with graphical objects on a much higher level, for example, we wouldn't have to worry about registering window classes etc, we'd just be able to open windows.

The biggest attraction was the possibility of writing to a toolkit that was available on more than one GUI. I rummaged feverishly through the product fliers and free sheets in the exhibition carrier bags that lived by my desk. I knew they'd come in handy one day.

'Portability between character and graphical window systems', brilliant, 'Identical source code. No ifdefs', even better. Apparently XVT Software Inc of Boulder Colorado had a toolkit that would allow us to run WordPlexbASE 123++ on MS-Windows, X and the Apple Macintosh.

XVT consists of several C function libraries which represent the Application Programming Interface or API. These libraries contain functions similar to those found in the various GUIs to handle most of the ugly details, such as creating and manipulating windows, memory management, drawing graphic objects on the screen, and dealing with system events and messages. Once we'd rewritten WordPlexbASE 123++ this way, porting to a different GUI would simply be a matter of recompiling on the target environment.

This sounded too good to be true. Surely there would be some performance hit, the extra level of software needed would ensure that. Although XVT allowed their libraries to be distributed royalty free, there was still the problem of relying on third party software. What kind of support would we get for problems that weren't in our code?

Portability was the goal, but what if we could get our application onto a number of platforms without the need to even recompile it? In the character based world, the solution lay in using terminal standards such as the DEC VT100. Then the answer dawned on me. What if our application could continue to function in the old way, using escape sequences to drive terminals, but could have access to the extra capabilities of a GUI? I was just drafting my letter of resignation to CJ (just two words), and looking for the phone number of our local venture capitalist to fund my brilliant technological breakthrough, when another hand-out caught my eye. Somebody had beaten me to it!

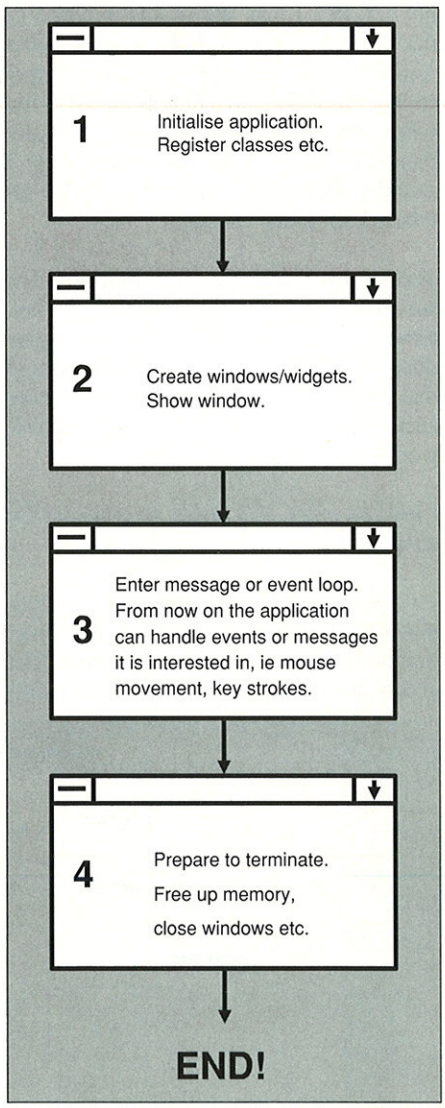
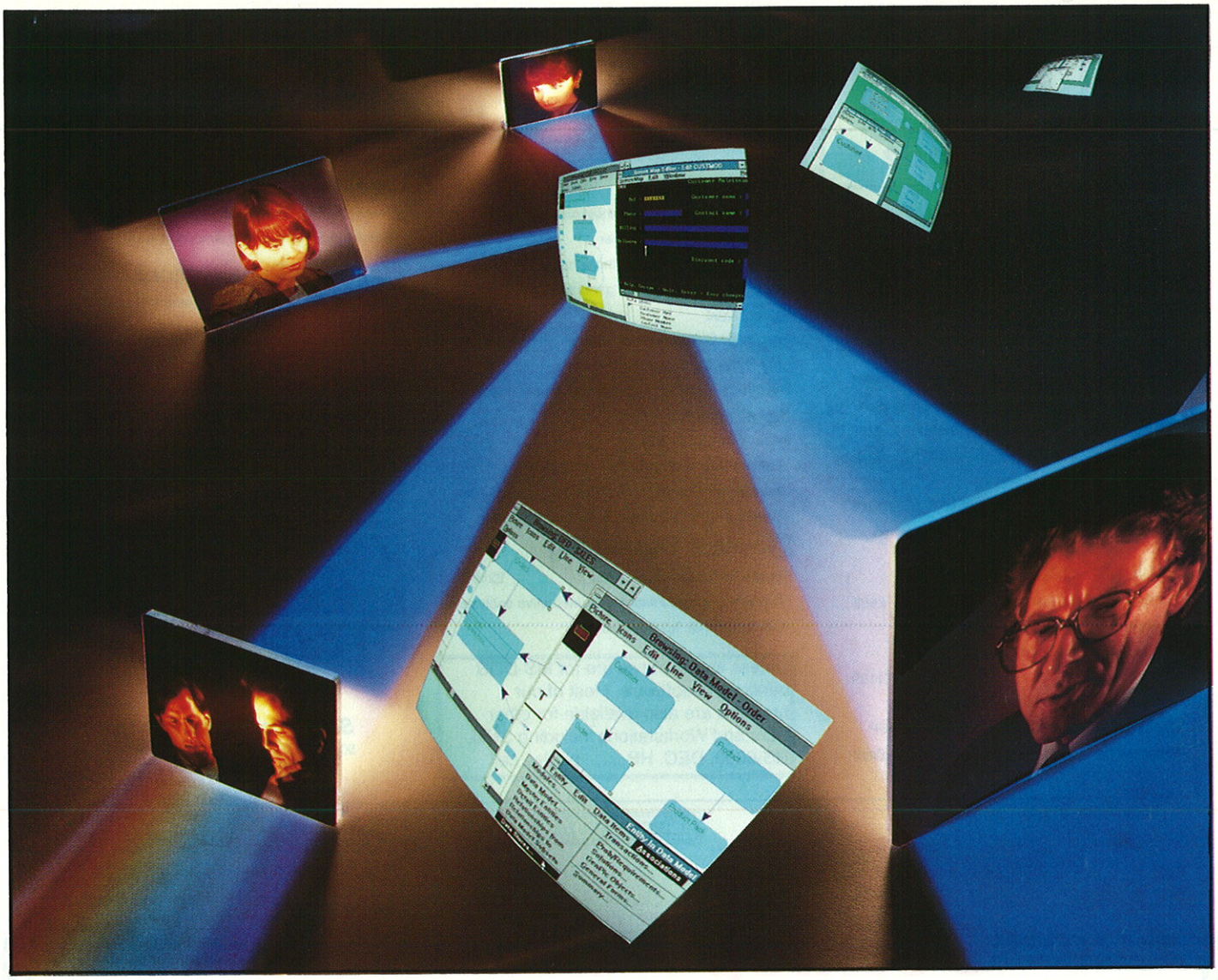


Figure 2 - Typical GUI Application Structure



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An organisation calling itself the International Association for Character Windowing Standards had decided to produce a terminal specification which would allow applications to create and manipulate windows using escape sequences. Looking through the brochure it seemed that some pretty big names were involved - DEC, WYSE, JSB *(who are they? Ed)* and SCO to name but four. The only problem was it only applied to character terminals.

Do good things come in threes? It seemed so. 'Bring GUI Ease of Use to Existing Software' read the next piece of paper in the carrier bag. IXI, a Cambridge company, had developed something called the X.Deskterm protocol. This was like the IACWS protocol, but applied to bit-mapped screens. Although it had been developed initially with an X front-end, JSB had written a Windows 3 implementation. True, there was no Macintosh version available, but in the immortal words of Meatloaf 'Two outta three ain't bad.' The advantages seemed clear. We'd be able to keep the essentially character based nature of WordPlexbASE 123++, but with some extra coding we'd be able to have access to GUI objects such as dialogs, scroll bars, mice, and features such as menuing would have the look and feel of the GUI.

The pros and cons of the approaches seemed to be like this. XVT would give us access to the three major GUIs, and possibly others in the future, but it would involve a major rewrite of WordPlexbASE 123++, and it would commit us to third party software. This last point would also be true of Deskterm to some extent, but IXI's aim is to make the Deskterm protocol a non-proprietary standard. Deskterm would also allow us to keep much of our existing code, adding merely the amount we needed to include concepts such as scroll bars or fonts.

Conversion Software

Conversion software is a means of encapsulating applications. This means that the application runs unaltered, but is placed inside a software 'bubble' that can interpret its behaviour, and map this onto the target environment.

I'd already read about Deskterm, but it appeared that there was a tool that would allow us to run WordPlexbASE 123++ in its usual fashion, as if it were driving a VT100 or ANSI terminal, but which would convert this protocol to that of Deskterm. This tool was called Soft Option. Using Soft Option would involve writing a script describing the behaviour of WordPlexbASE 123++, and the interface we wanted it to present to the user, in a simple English-like language. In our script we'd be able to describe 'hot' areas on the screen, for instance the ring menu at the top of WordPlexbASE 123++'s spreadsheet, then react to changes in this menu by changing a Windows or X style menu. We could also use the status line of our word processor to decide that the window needed a scroll bar. The possibilities seemed endless.

Resignation

It looked like this drastic action wouldn't be necessary.

We couldn't rewrite WordPlexbASE 123++ for each GUI, Norm and I couldn't manage it in the six months. So it boiled down to:

i) Doing a major rewrite to a toolkit like XVT, which would involve learning all about the functions available, and restructuring the application to use them;

ii) Retaining the essential nature of WordPlexbASE 123++, adding only the code necessary to implement the GUI features we desired, using a protocol like Deskterm;

iii) Using an encapsulation method like Soft Option, which again involved a great deal of learning and analysis of WordPlexbASE 123++, but no changes to the application sources.

I worked late into the night on my carefully reasoned report.

Shock Horror!

The day started badly. I was late, signal failure at Clapham, and in my rush to answer the already ringing support 'phone, I knocked a half-filled cup of cold coffee over my keyboard. It was then I noticed that ominous yellow sticky note, right in the centre of my terminal. 'See me! C.J'.

'Look Norm, we must get multi-media, and we must get it now!'...

EXE

Norman and Norman were assisted by Mike McCusker and Glenn Pittaway. Mike and Glenn work at JSB Computer Systems Ltd of Macclesfield. Both work on the company's MultiView product. JSB can be contacted on 0625 433618.

Other contacts: XVT is distributed in the UK by Personal Workstations Ltd (071 4036698); Soft Option is produced by Connectivity Ltd (0954 51920) and Deskterm is produced by IXI (0223 462131).

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CIRCLE NO. 269

Acorn's new Programmers' Toolkits

Acorn have launched a new desktop development environment for RISCOS applications on the Archimedes. Jon Vogler reviews it and compares it with market leader Saber-C.

Why consider writing applications under RISCOS? Because there are 140,000 machines out there running Acorn's operating system for its super speedy PCs based on the ARM RISC processor. The latest, fitted with the ARM 3, run as fast as my Sun workstation but cost less than half as much, which is why Acorn was the fifth largest vendor of PCs in the UK last year, selling more than either Apple or Atari. To support its hardware, Acorn depends on its growing catalogue of application software: 1300 packages so far. The company has just invested six man years of effort to produce a set of programmers' productivity tools.

There are actually three products, but if you buy one you get two:

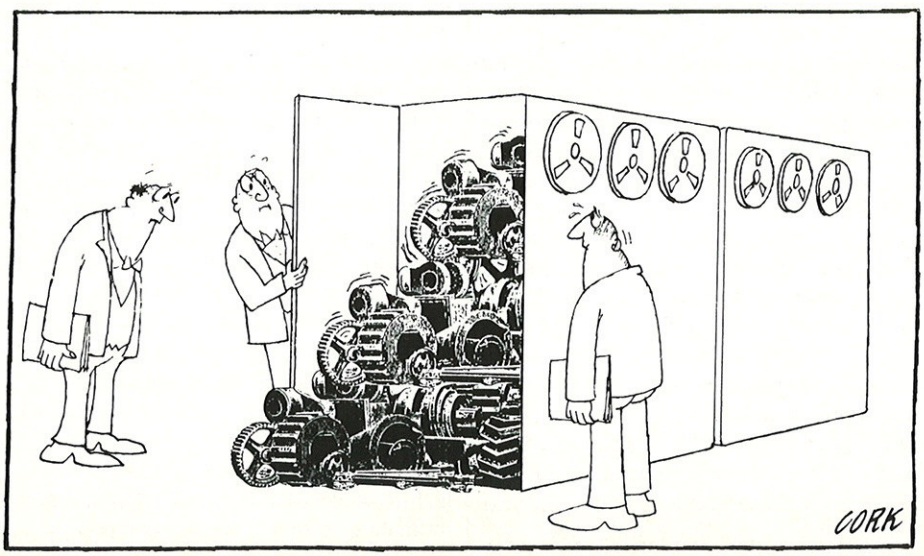
For £229 (+ VAT) there is *Acorn Desktop C* which, if you must equate everything to the DOS world, is equivalent to Microsoft C 6.0. It replaces Acorn's two year old ANSI C release 3 and can be used to write either flavour of C: ANSI or K&R. The 1989 standard set by the ANSI X3J11 committee (against which it has been tested with the Plum-Hall C validation suite version 2.00) should, of course, be used by any author writing a new application. However, those updating existing C code, are more likely to use the portable C compiler (PCC) which closely follows the definition give by Kernighan and Richie in the original edition of *The C Programming Language.*

The Sun-Saber combination costs about 10 x as much as Acorn's C package

£149 ex VAT buys *Acorn Desktop Assembler.* This replaces a four-year-old predecessor which came with neither examples nor documentation. By seamlessly merging the assembler coding environment with the C environment, the system encourages C programmers to drop into assembler for the hot bits, such as the repeatedly called graphics routines or the core sections of high speed loops, that make such a difference to program performance.

With both you get the third module: the Desktop Development Environment (DDE), which contains a set of language-independent programming tools and a programming interface designed to improve the productivity of RISCOS programmers.

There are three separate manuals: well written, nicely produced, thoroughly indexed and full of helpful appendices. However I would have liked a separate tutorial chapter covering, from start to finish, the many examples sprinkled throughout the text, source code for which comes with the software.



RISCOS Tools

Programming has long been a non-interactive, almost linear (command-line) activity: rather like writing a letter to a friend: you post it, wait for a reply, in response to which you write again and so on. DDE converts it into an interactive, two-dimensional process, more like a dance: you repeat various

sequences and your partner responds and sometimes you touch and react to one another.

Thus, to compile a piece of source code you drop its icon onto the compiler icon, do likewise to link it; set options by pop-up windows and dialogue boxes and you never need issue a command to see process output - DDE opens a window spontaneously and displays it. Neither program nor compiler 'knows' anything about this; your end product will run perfectly well on a system on which no productivity tools are installed.

This 'front end' function is provided by a separate module, which uses a formal mapping between the wimp interface and the various command line options. It is used both to operate the tool kits and in the production of new applications.

The DDE tools are used to produce the various 'icon sprites', boot and set-up files, help files and windows. A set of predefined template files for window building are included in the RISCOS library, such as a file information window, font and typeface selector panels, a box for searching for text strings and another to goto a selected line number and a confirmation panel for after the 'kill' button is pressed. To create one's own templates there is a form editor tool which is a programmers dream: he paints on the screen the window he wants, specifying size, colour and arrangement of panes, whether vertical or horizontal scroll bars are to be used (and, if so, what should be the bounds through which they scroll) the placement of icons, whether the pane should be movable or automatically redrawn (after being obscured by another window), what help screens are attached and many other features, each matched to equivalent command line options. Save the whole in a file and it becomes instantly executable, so you know, immediately, whether you have produced the correct kind of object.

The C Tools

Unmanaged compilation (usually of smaller programs; for larger ones you use Make) gets full support from the interface. You drag-and-drop the source file onto the compiler icon and are offered options: compiling without linking, preprocessing without compiling, including debug data in the object code (the cc -g option) and enabling 'throwback'. Throwback is a good example of how the separate DDE tools co-operate. If the C compiler or the assembler finds an error in a source file, this is listed in a window and can be selected with the mouse. This automatically opens a source edit window, with the apparent location of the error indicated so it can be immediately corrected. This is particularly handy for those stupid errors, like omitting the semicolon at the end of a line of C, which you want to get out of the way before you get on with serious debugging. More obscure compile-time options are relegated to a pop-up menu so you need not touch them unless required: choice of libraries, PREDEFINEs and UNDEFINEs, special debug options (like the -f option, which only generates information on functions and top level variables - those outside functions - so as to reduce the amount of debug output), setting the directory where cc should place its output, defining the search path for `#include` directives and the rest.

By merging the assembler and C environments, the system encourages C users to drop into assembler for the hot bits

In operation the programmer is unaware whether the tools he is using are part of the language toolkit or the desktop environment but, to keep the record straight, the C tools include the compiler with its set-up procedure, the conversion programs between ANSI and PCC and the CMHG header generator: a tool to enable relocatable RISCOS modules to be written entirely in C by those who cannot afford the assembler product (or, more likely, are terrified of assembly language). CMHG automatically generates the header table that occurs at the start of every relocatable module, and points to various items of data and code. The handbook contains useful information on writing relocatable modules as well as some hints about memory usage from relocatable code. Finally, of course, the C module contains the RISCOS library and the ANSI C library. No separate library is needed for the portable C compiler: you simply set a switch at compile time.

For authors who want to upgrade existing code to ANSI (or who just cannot make up their minds which to adopt) a couple of neat tools are included: ToANSI and ToPCC which help convert source code written in one style to the other. For example a PCC function definition

```
void c_data(a, g)
float a;
int g;
```

will be converted by ToANSI into:

```
void c_data(float a, int g)
```

These can't do all the work for you: the ANSI standard is much tighter than K and R, but I found the handbook helpful in listing features (of both the language and the libraries) where C authors may get an unpleasant surprise when converting existing code to ANSI.

Interactive Tools

Probably the most exciting part of the whole tool kit are the interactive tools: particularly the Make tool and the debugger.

The debugger provides facilities familiar from such C debugging programs as `adb`, `sdb` or `dbx`, but it displays the source code in a scrollable pane, with a pointer in the margin to indicate which line of code is currently executing. In a separate status pane (which can be moved and resized independently) debugger information is displayed. Using pop-up menus you can select aids which, with conventional debuggers, you would have to type in as commands. You can single-step through the code, specifying (via a dialog box) whether to enter procedures or merely call them, step by source statement or by ARM instruction, how many steps at a time and so on. You can call specified procedures or return from the current procedure. You can set a whole series of interrupts: breakpoints at specified lines, procedures or events; watch-points that will spy on a given variable or memory location and flag every time it changes its value; traces which notify you when a variety of actions occur (usually used as an alterative to stopping execution). The likeness to a dance is unmistakable if you trace execution: the pointer performs a veritable gavotte around the source code.

You can alter the values of variables, registers or even memory locations directly and also enter RISCOS * commands into the debugger window: for example to discover what directory you are in or the value of a search path if a file is not being found. One feature which I found both helpful and infuriating is that it turns off the normal

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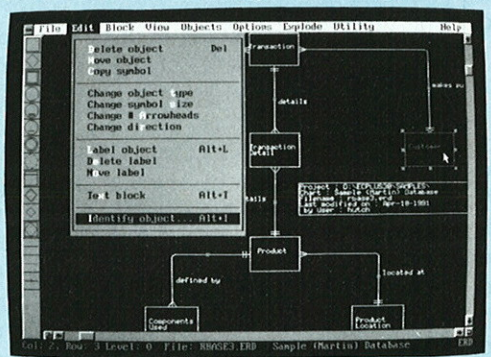

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CIRCLE NO. 271

RISCOS multi-tasking (in order that it can stop program execution at any point). One result is that, if you set some long procedure tracing at machine code level, the thing goes on and on for ever and you may end up rebooting in despair. Acorn told me that Shift-f12 actually does the trick but I could not find it in the handbook.

The Make utility

The tool kit provide two utilities for automating program construction. AMU is a cut-down version of Make, designed for use where memory shortage makes the large size of Make a problem and where the extra facilities are not needed. Make itself not only enables you to use Makefiles but also to construct them. For each 'project' there is a dialog box. When you have written a new source code component you drag-and-drop it in the insert pane of the dialog box and it will automatically be included in the Makefile. Likewise you can remove unwanted source files and can add or subtract object files, such as external libraries, by specifying whether the target is the executable 'run-image' or a library. Make provides a variety of options, most of which are other tools in the DDE kit (such as the C compiler, the linker or the assembler) or utilities such as squeeze. To start a complete project compilation you simply drop the icon for the completed Makefile on the Make icon. You can edit Makefiles using the source editor. For example, you might enter instructions to remove an application's binary image, and the object files used to create it, so that the next time Make runs it will remake all objects, not just the new ones. However Make overwrites all but one, user-editable section, so you need to know exactly how things work.

Other DDE Tools

Among other DDE tools: *Diff* displays the text differences between two files, line-by-line, *Find* searches file names and contents for text strings, throwing back into the source editor if required, *LibFile* creates and maintains library archives, *ObjSize* reports on the code, data and debug size of an object or library, *Squeeze* compresses executable code to save disc space and make the program load faster, *WC* counts lines, words and similar objects in a file, *Common* counts the frequency of words in a file and *DecAof* and *DecCf* decode and analyse object files and return information about their areas and 'chunks'.

Assessment

This workbench will be heartily welcomed by every programmer who writes applications for RISCOS and the Archimedes. Not only do individual tools, particularly the debugger and the Make tool, significantly reduce programming effort and stress, but the interaction between them, whereby the output from one can be fed into another with a couple of mouse clicks, will decimate program development time. In particular the form editor will spur those who hitherto hesitated to write for a wimp environment because of the sheer labour involved in shaping windows.

I have one overall criticism: the system requires too much muscle power! Programmers are lazy devils ('economical' if you prefer) and many will object to how far the mouse travels. Too many small windows are opened and lie around the desktop in overlapping piles. To get enough

Saber-C

As a yardstick against which to compare the Acorn product I tested Saber-C (Version 3.0.1). This has been incorporated by IDE into an integrated CASE system that also contains Software through Pictures, a system design and analysis tool, and a documentation package (either FrameMaker or Interleaf) of the customer's choice. IDE claims that this will be the most completely integrated CASE package ever produced, allowing software engineers to proceed more efficiently from systems analysis to run-time code, with less manual intervention, than ever before.

However Saber-C is also sold as a stand-alone package by K2 at £2195. On the screen it resembles the `dbx` debugger but in operation it offers far more. One of the five panels that make up the main window not only displays the source code and indicates the statement that is currently running; it also allows you to edit and reload source without having to move to a separate window. If you need more extensive editing you can automatically invoke `vi` or emacs and these do launch in a supplementary window. Having corrected your file, a single mouse-click loads the revised source and you can supply command line arguments or redirect input or output files as required.

This extremely slick cycle is achieved by use of a C interpreter. There is no need to compile source before you can debug it; the interpreter handles this and at the same time detects errors which might otherwise not have surfaced till well on in the development cycle. Among the static errors for which it checks are bad syntax, illegal values and expressions, errors in pre-processing, undefined identifiers and variables that do not get used. However note the downside: that no compiler is included with the package; however Unix-like operating systems all include the `cc` compiler. Saber defaults to `cc` unless you specify the `ansi` option.

A set of graphical browsers enable you to penetrate below the surface of your code: for example to list (and examine if necessary) all the libraries to which it is being linked or to display (as a flow-chart) the relationships between data structures or to follow the trail of pointers, for example along a linked list.

My greatest enthusiasm was reserved for the small details that contribute to superlative user-productivity. Any text can be marked for selection and pasted but if you select a file name then that file is proffered as the default to pop-up menus. The workspace uses a syntax reminiscent of the C-shell to repeat previous commands, either by tokens, by command number or by scrolling back and marking and there is command-line editing as well as string substitution. If you find you are frequently selecting a command from a menu you can instantly incorporate it as a button on the options panel. You can do likewise with your own commands and the buttons you create are remembered for future sessions.

Finally Saber proved reasonably efficient at avoiding an over-cluttered screen. Dialogue boxes are intelligently positioned and there are fewer supplementary windows as a result of the source display and editing panels being one and the same. The browser can be used as a base-board for mini-panes in which the value of a variable or an expression can be displayed and these can be positioned, scrolled or dismissed as required. You can alter fonts on all panels so as to get more text visible and can vary window sizes accordingly.

This description of Saber has been restricted by space to aspects of the user interface. For more details, please see 'Tools for program development', .EXE October 1991.

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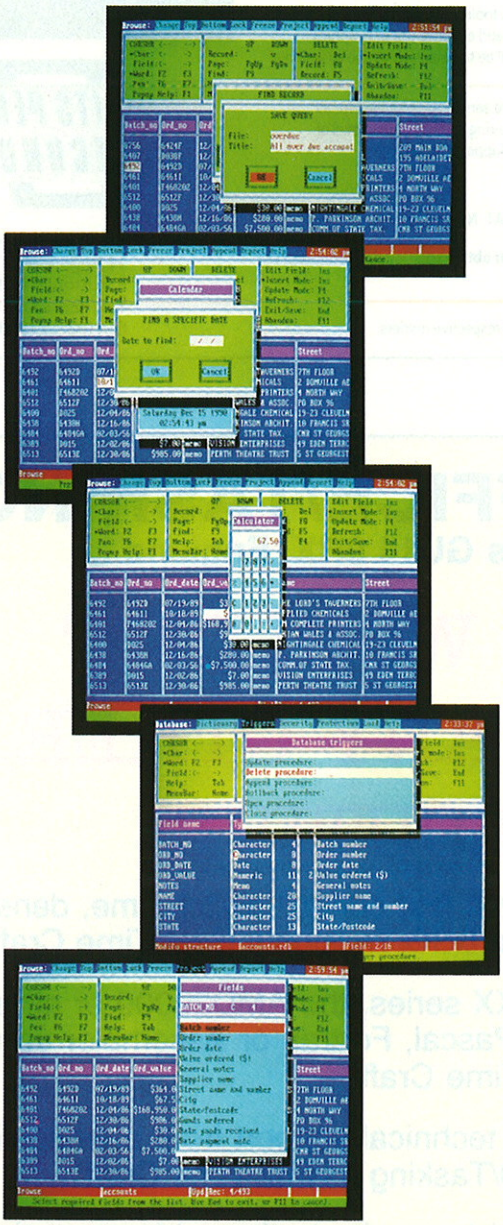

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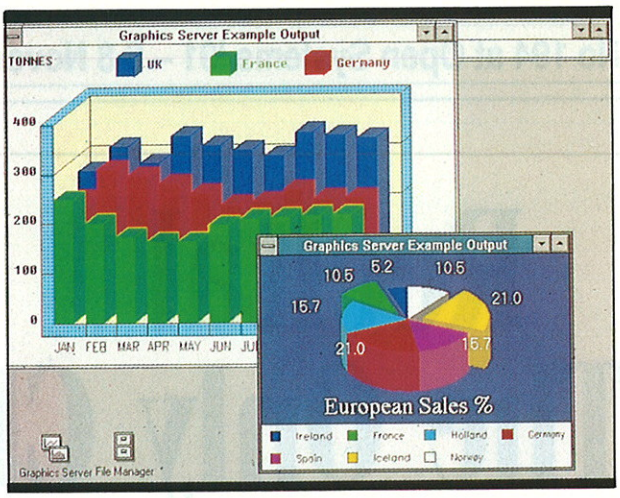

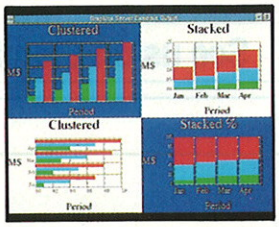

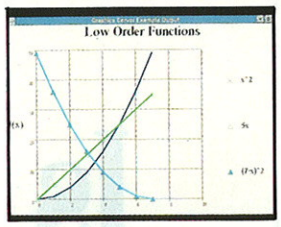

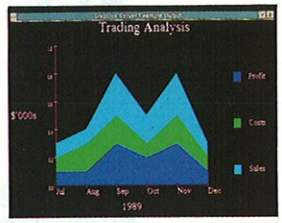

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space to work I replaced my standard 640x512 monitor with a biggie of 1056 horizontal pixels; I became fed up with long mouse drags (albeit lessened when I discovered the Archimedes has an option to gear the mouse higher) to drop .c file icons on the menu bar. All this is a wonderful incentive to use Make for even modest tasks. I was irritated by the positioning of some dialog boxes: looking for a text string, the find box was always placed to obscure the piece of source that contained the string. Nor would it restart searching at the top of the file when it failed to find a string below the start point. Likewise with the throwback facility: handy to use but irritating that the compiler pane contains almost identical information and both need to be closed manually. In fact you can reduce the amount of text in the compiler pane to a summary but you get another window opened regardless.

How did it compare with Saber? My biggest complaint is that you cannot edit source in the debugger. You perform three separate tasks - edit, compile and debug - each with its own windows, which Saber combines into one. (Acorn points out, with some justice, that its separate functional modules will encourage users to incorporate their own tools). Second, I longed for `vi`; the Acorn editor is fine for hobbyists but serious programmers use `vi` or emacs. Third, the Acorn product is not quite as good in respect of all those little timesavers: cut-and-paste, remembering previous arguments, repeating and editing commands and user-generated buttons or menu lines. I found that I worked in a far more relaxed fashion with Saber under Sun's Open Windows than I did on the Arc. One final thing was inexcusable: Acorn's example of a buggy program worked on my mono screen without me having to fix the bug (which only bites when colour is being used)!

The likeness to a dance is unmistakable: the pointer performs a veritable gavotte around the source code

It is a pretty tough comparison: the Sun-Saber combination costs about ten times as much as Acorn's C package so, while I would use Saber in preference, as value for money the Acorn product comes out well. I have no doubt that all serious Acorn programmers will go for it. Many coders who are bored stiff with DOS, its memory limitations and complicated windowing routines, will probably do likewise and start enjoying programming again.

EXE

Jon Vogler, a Chartered Engineer and Member of the British Computer Society, is a computer consultant and freelance writer on Unix and business computing.

Contacts: Acorn Desktop Development Environment from Acorn: 0223 245200. The prices given in the text are discounted to ISVs registered with Acorn and also to users upgrading from previous Acorn products - call the company for details. Software through Pictures from IDE: 0483 579000. Saber-C from K2: 061-776-4541.

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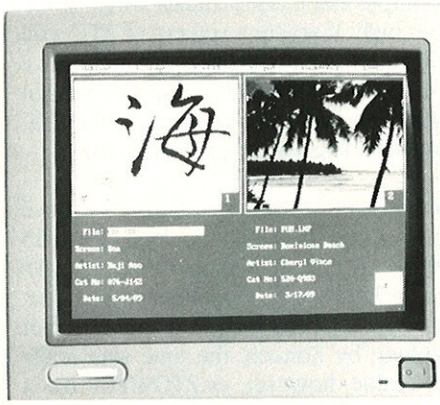

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CIRCLE NO. 275

Zortech C++ V3.0 - Grandson of C++

Zortech was the first company to produce a full DOS-native C++ compiler. V3.0 of the software is a poly-platform, multi-featured giant, as Laine Stump found out.

Americans have an expression about being 'nickled and dimed to death'. That's when, for example, you buy a cheap car, but lose all your initial gains due to multitudes of petty maintenance and add-on expenses.

That can happen when you buy a compiler, too. Sure, the compiler is only $100. But by the time you've bought a DOS extender to to write huge programs, the MS Windows SDK, object libraries to ease your workload, and all those other nifty add-ons, you've spent just about as much as if you'd given up programming and bought a used Cessna 152 instead.

Borland started a good trend by bundling a functional equivalent of the Windows SDK in Borland C++. Now Zortech has done one better. Its C++ V3.0 Developer's Edition is the has-all, does-all of MS-DOS based compilers. You'd better sit down while you read the highlights of what it contains:

- C++ compilers for DOS, Windows, and OS/2
- Full cfront 2.0 implementation, some 2.1 features
- S, M, C, L, and V (virtual code) memory models
- Z model 286 protected mode DOS extender
- X model 386 protected mode DOS extender
- Z and X versions of all compiler binaries
- Debuggers for all modes except Z and X
- WinC libraries - recompile DOS apps for Windows
- Source code to most all libraries
- DOS TSR development package
- C++ Tools class library
- A C++ source code browser

Anybody can create a product with a long list of features. But do they perform? Let's find out.

Installation

Opening the box of your new compiler (henceforth called ZTC), you are faced with eight 1.44 MB 3.5 inch diskettes and a stack of purple and black manuals about six inches high. If you're a veteran of ZTC, you will rightly guess to put disk one in the drive and run ZTCSETUP. This starts the installation which results in chosen parts of the ZTC system finding a home on your machine.

Before starting, make sure that 1) you have *scads* of free space on your drive (about 15 MB on my system, without OS/2 support), and 2) you have up to an hour of free time. Installation takes a *long* time. Due to clever thinking by Zortech, the time isn't really noticeable, however, as ZTCSETUP has a window where you can view the various README files while the diskettes are installing. You'll simply be interrupted now and then to insert another disk (in any order - nice touch). I hadn't quite finished reading all the READMEs when the installation completed, so I remained in ZTCSETUP for a few more minutes to browse through the last couple of files.

If you need to install it a second time, though... I would suggest bringing along a good book - It took 55 minutes on my 12 Mhz 286 (somewhat less on my 20 Mhz 386sx).

Documentation

Borland C++ suffers from a lack of Windows documentation. Zortech has remedied that (partially) by licensing the *Windows Function Reference Manuals* (Vols 1 and 2) and including them (in book and WINHELP form) with ZTC. Although seriously lacking in Windows tutorial/philosophy material, at least you have a list of all the Windows functions, with prototypes and descriptions.

There is also a *Windows Programming Guide*, which gives instructions on compiling for Windows and using the Windows oriented utilities (eg the Help Compiler). And they've thrown in an amusing *Windows Quick Reference Card* containing the entire programmer's API, which unfolds nearly the entire length of your arm. (Seri-

MSC	ZTC	Explanation
/Ax	-mx	sets memory model (x = S, C, M, or L)
/Axw	-mxw	as above, SS != DS
/Axwu	-mxwu	as above, reload DS on entry
/Gw	-W1	full Windows prolog/epilog
/GW	-W2	reduced pro/epilog for non-exported functions
/Zp	-a1	align on byte boundaries
/NT	-NT	sets name for code segment
/c	-c	compile only

Figure 1 - some MSC/ZTC switch conversions

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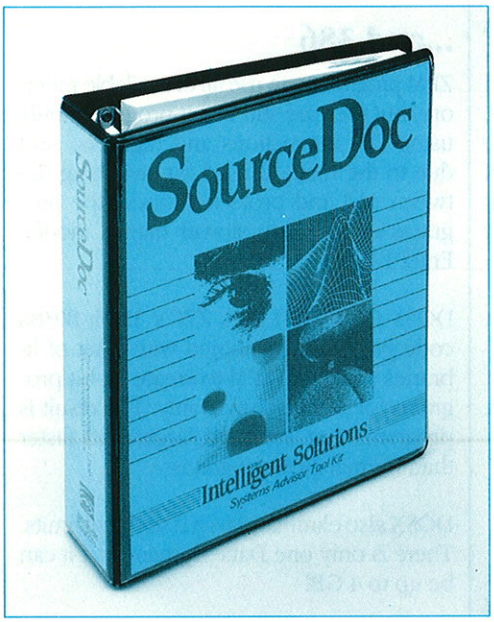

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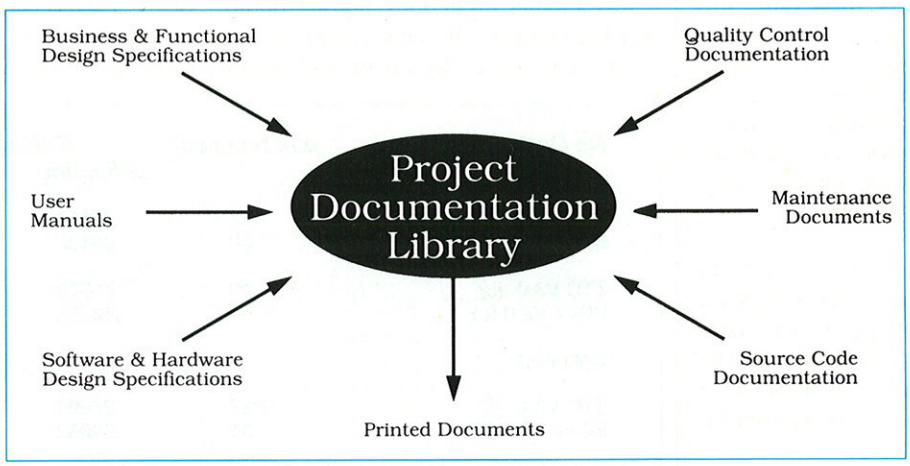

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CIRCLE NO. 276

ously, though, it's quite useful. And next to impossible to misplace.)

Also in the stack are the *Function Reference* (non-Windows), the *Compiler Guide*, *C++ Tools*, and an *Installation Guide*.

Besides Windows tutorials, one other topic is lacking in the documentation: the comparison of MSC vs ZTC compiler switches (hidden in the Installation Guide) is very incomplete, making it difficult to follow examples in some Windows programming books (or the SDK examples). Zortech should take a good look at the 'Conversion Guidelines' section of BC++'s *Getting Started* book.

Otherwise, I found the documentation complete, up to and including a nice introduction to C++. Don't make the mistake of thinking that you can get by without, eg, *Programming Windows* (by Charles Petzold - Microsoft Press) though.

Memory Models

Like every other compiler, ZTC has the normal Tiny, Small, Medium, Compact, and Large models. It also has V model (Virtual Code Management, or VCM), which is similar to overlays, only more flexible. In VCM, modules are loaded wherever there is space, rather than in a fixed position.

Extender 286...

If you have a 286 and lots of memory, ZTC has just the model for you: Z (Zortech Protected Mode, or ZPM). ZPM is a 286 protected mode DOS Extender similar to Rational Systems DOS 16/M (also supported, if you need its few extra features and want to pay the price). ZPM programs can use all available memory on a 286 or higher CPU. This is accomplished with a special library which switches back to real mode for DOS calls while running the application in protected mode.

ZPM is fully compliant with DPMI, VCPI, and XMS. Programs compiled with ZPM can run as a Windows DOS app, in Real, Standard, or even 386 Enhanced mode. (A ZPM program cannot act as a DPMI Server, it only coöperates with one if it is present.)

Porting a program from L model to ZPM is usually as simple as changing the memory model switch when compiling. I made this change with one of my own programs (16 files, 60 KB source), and the only problem I saw was with an errant null pointer that had gone undetected in real mode. ZPM dutifully reported that I had attempted to dereference a null pointer, gave me a register dump, and halted.

As there is currently no debugging support for ZPM, I was forced to fill my program with `printf()`s to find the culprit (a comparison of two `char*`s, one of which was NULL). The lack of debugging is my only gripe about the ZPM extender.

...and 386

ZPM programs can use all of available memory, but they are still 16-bit programs, only using 286 instructions and registers. And due to the method used for switching between real and protected mode, the programs tend to run slower than L model. Enter DOSX.

DOSX (X model) uses ZTC's 32-bit 80386 code generator combined with a set of libraries similar to ZPM to create 32-bit programs for 386 machines only. The result is programs that are both larger and faster than normal DOS programs.

DOSX also eliminates 64 KB segment limits. There is only one Data segment, but it can be up to 4 GB!

Like ZPM, DOSX is also fully DPMI, VCPI, and XMS compliant. Both extenders are also royalty free, by the way. You can distribute your applications freely.

Again, programs are 'ported' from DOS to DOSX by changing the memory model switch on the ZTC command line (to -mx). And again, I had only a couple small problems with the test program. Problem One was due to integers being 32-bits rather than 16. Problem Two was more elusive, as it was another mysterious 'register dump and halt' bug. In the end, I learned that (contrary to the Zortech manuals), DOSX programs cannot access video memory through a far pointer created with `MK_FP()`. Instead you use a function called `_x386_mk_protected_ptr()` to construct the pointer. Changing these, my program ran fine in 32-bit mode.

The biggest problem, again, was the lack of debugger support. Although Zortech is promising DOSX and ZPM debuggers in the future, and you can fake things by first compiling for L model to debug, it's a real handicap.

Past versions of the Zortech 386 product required the Phar Lap 386 Extender. Although Phar Lap is still supported, it is no longer required.

Compiler Executables

Zortech makes heavy use of its own DOS Extender products. ZTC includes three different versions of the compiler and linker - the same programs compiled with L, Z, and X model. You can produce all types of code with any of the compiler versions, but they are each useful in different situations. L (-b) is the only choice on 8088s. 80286s should also use the L version unless the programs are too big, as the Z version (-br) compiles slower (although it can handle very large programs). Unless there is a compatibility problem, 80386s should always use the X versions (-bx), as they are just as fast as L, and can compile gigantic programs.

Since all ZPM and DOSX programs are DPMI compliant, these versions of the compiler can run in a Windows 386 Enhanced DOS Box. My version (2.0) of Borland's BCCX, a 286 version of BC++, can only run in Standby Mode, making Windows programming less convenient with BC++.

No Optimisation	***compile(sec)***	***EXE size (bytes)***	
		w/floating	***w/o floating***
ZTC V3.0 (S)	41	26960	21420
BC++ V2.0 (S)	50	34692	20556
ZTC V3.0 (L)	42	33570	28288
BC++ V2.0 (L)	51	42298	28330
Optimised			
ZTC V3.0 (S)	1:32	24992	19888
BC++ V2.0 (S)	51	34052	19916
ZTC V3.0 (L)	1:33	30962	25680
BC++ V2.0 (L)	52	40858	26890
ZTC V3.0 (Z)	1:34	42512	37392
ZTC V3.0 (X)	1:34	41231	36167

All BC++ compiles were done with BCC.EXE (real mode version), while ZTC compiles were done with ZTC X binaries (386 mode). BCCX (required for large compiles) is about 20% slower.

Figure 2 - Comparison of Compile time and EXE size

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Thoughout the 1980s, Xoren Computing pioneered the development of inexpensive yet reliable communications software. Today, the XOREN IPL-11 range is renowned for enabling automated file transfer between any quantity and combination of the major minis, micros and PCs in configurations which will become more and more commonplace through the 1990s.

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1981: Remote activation facility incorporated allowing file transfers when remote computers are unmanned.
RSTS/E, RT-11 and RSX-11M PLUS versions released for DEC PDP-11.

1982: Terminal emulation facility introduced enabling the use of a terminal on a local computer as a terminal on a remote computer thereby allowing control of file transfer sessions from a single terminal.
TSX PLUS version released for DEC PDP-11.

1983: Option to control file transfers from command files as an alternative to control from operator's keyboard.
P/OS version released for DEC Professional.

1984: Mechanism built into the package protecting against "message bouncing" due to line noise when computers remain connected and the package is not in use.
MicroRSX and MicroRSTS versions released for DEC MicroPDP-11.

1985: Commenced development of new portable versions written in the programme language 'C'.

1986: First releases of new portable versions written in 'C' for PC-DOS, MS-DOS, UNIX, AIX and VMS.

1987: Portable versions support simultaneous multiple links.
IPL-11 wins ICP Million Dollar Award.

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Zortech Workbench

ZTC includes an attempt at an integrated environment called Zortech Workbench (ZWB). Although I think its 'project make' support is half-baked, and could never really warm to the program, it does have a couple of nice features. In particular, combined with the error browser that most environments have, ZWB also has a 'grep browser' which uses the output of grep to browse through your source files.

As much as I tried to use ZWB, though, in the end I was back to a combination of Brief, the Windows Notepad, and makefiles.

ZDB Debugger

ZDB V3.0 is the same ZDB we've always known. As well as a real mode debugger, a remote debugger, and a 286 Protected mode debugger (ZDB runs in protected mode, but only debugs real mode programs), there is now a ZDBW for Windows.

The Virtual 86 mode debugger included in earlier versions of ZTC has been removed in V3.0 due to compatibility problems with other 386 environments.

Despite the absence of debugging support for ZPM and DOSX programs, there is a ZDB for debugging Phar Lap 386 programs.

Although lacking some features of Borland's Debugger (eg, reverse execution), ZDB has some tricks of its own. One useful tool is Heap Protection - ZDB monitors calls to `new` and `delete` (or `malloc()` and `free()`) and keeps them in a buffer. You will be immediately informed if you try to free the same block of memory twice. At the end of your program, a quick look at the Buffers Window will tell you if you have dangling allocations.

I personally prefer ZDB over Turbo Debugger because of its mnemonic commands. I find it much easier to remember (and reach!) 'S' to single step instead of F7, for example.

W*nd*ws!

If it weren't for the DOS Extenders included with ZTC, its Windows support could have been big news. Zortech includes its own WINDOWS.H (Microsoft's with some modifications to suit C++better) and all the Windows libraries. It has also licensed the Help Compiler, IMPLIB and the Resource Compiler from Microsoft.

The ZDBW debugger uses display switching to allow debugging Windows programs with a single monitor, and also supports a secondary monitor. According to the manual, you can only debug in single monitor mode if you have a VGA in 640x480 mode.

ZDBW has several nice feature for Windows programmers. For example, it displays all the `WM_???` messages sent to Windows call-back functions as, eg, `WM_PAINT` rather than some strange integer value. There is also a 'Windows Text' window which records all debug output messages from your program (via `OutputDebugString()`) and the Windows Debug Kernel (if you have it installed).

Also included is an interesting program called WindowsMaker Prototyper. WindowsMaker allows you to build an application's user interface interactively, testing it as you go. Unfortunately, once I had designed all my menus and dialogs, and how they were linked, I bitterly realised that I could only save them to a special file read-

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able only by WindowsMaker. Dialog boxes may be saved to .DLG files for use in Windows programs, however.

The 'Professional' version of WindowsMaker can generate an entire program (in C) which implements your interface. But when you try to do that with the 'Prototyper' version, you get a message saying: 'If you want to do this, purchase the Professional version from...' Of course, Zortech's reason for including WindowsMaker is as a replacement for the SDK Dialog Editor. They didn't make that clear in the documentation though.

Although WindowsMaker is much faster in operation than the Whitewater Resource Toolkit (included with BC++), I still use WRT because it has more capabilities than the neutered WindowsMaker - it can't even save menus to an RC file.

Also, there is no Icon editor! WindowsMaker attempts to run SDKPAINT (from the MS SDK). I was surprised to find such an important link in Windows program development missing. The lack of a Font Editor is less bothersome (BC++ doesn't have a font editor either).

SDK Compatibility

Many of you will use ZTC to compile example programs from books like 'Programming Windows' and its kin, which are written for MSC and the Microsoft Windows SDK. Do these programs require change for ZTC?

Of the programs from Petzold that I ran through ZTC, no .C files required any change. The only difference was in the MAKE scripts, which needed different compiler and linker names, and switches.

I tried the same with a couple examples from the MS SDK - CLOCK and MULTIPAD. These took a bit more effort. Aside from the changes to MAKE files, CLOCK required a prototype for one forward referenced function, while MULTIPAD needed several prototypes, as well as some explicit typecasts (ZTC correctly refuses to cast directly from `short` to `far *`).

Once MULTIPAD compiled, I ran it to learn that it wouldn't open any file over a few lines long. Investigation with ZDBW showed that `LocalRealloc()` in Zortech's library was not expanding the local heap when necessary - it was simply returning a failure. Both the MSC and BC++ libraries behave differently. Zortech is now aware of the problem, and until they fix it I can just declare a larger heap in my DEF file.

Overall, ZTC can be a functional replacement for MSC + SDK as long as the code adheres to ANSI standards. MSC allows non-portable code to sneak in, though, and that can cause problems.

Although it is incomplete, Figure 1 is a list of the MSC switches I encountered and their ZTC equivalents.

Windows++

You shouldn't consider ZTC as just a replacement for MSC + SDK, though. The real fun starts when you start using C++ features in your Windows programs. As Windows is highly object-oriented itself, it lends well to being encapsulated in C++ classes. Zortech includes a short Windows program which does just that - it creates a class hierarchy containing many of the standard window types, enabling you to treat all the different windows in a consistent manner. It's nothing compared to Zinc or Win++, but it's educational to experiment with.

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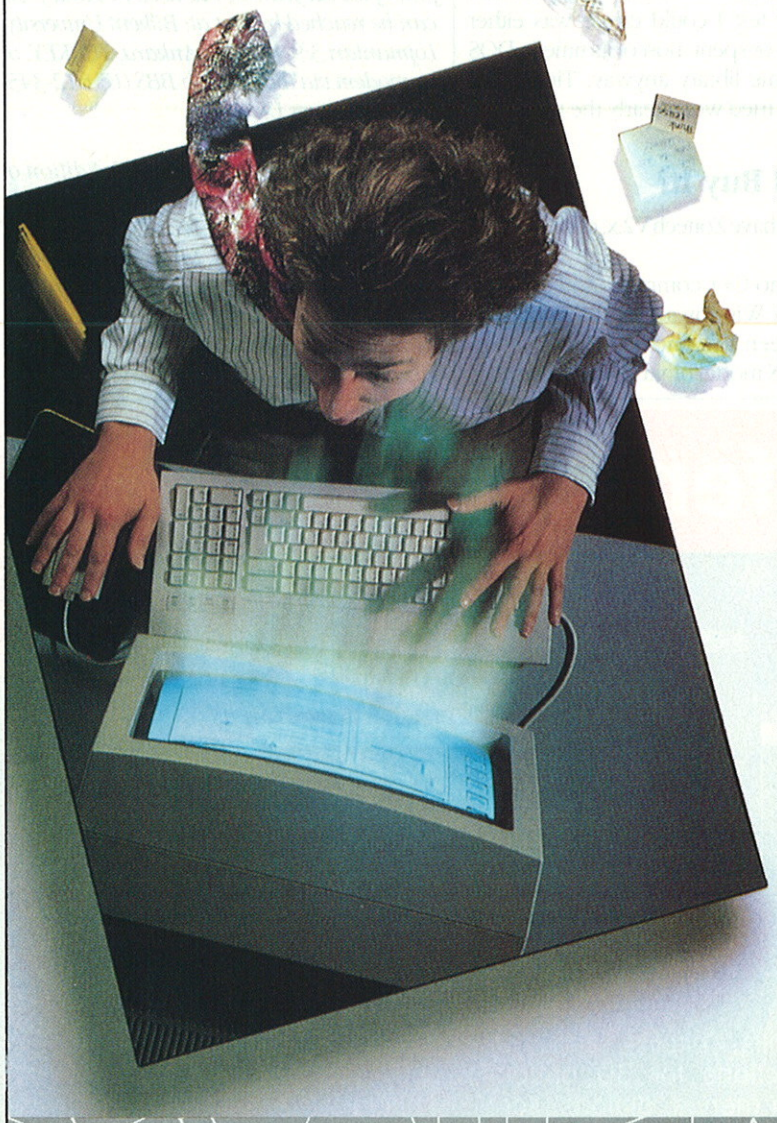

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Performance

To compare compiler performance (Figure 2), I compiled a program I wrote to test a `StringEditor` class. It comprises 16 files, total 60 KB. All ZTC compiles were done with the X version of compiler binaries (386 protected mode), while all BC++ compiles were done with BCC (real mode). While the ZTC X mode binaries had about the same time as real mode equivalents, BCCX (the 286 protected mode Borland binary) took about 20% longer than BCC. ZTC Z (286) binaries were 30% slower.

Based on past experience with earlier versions of both compilers, I was surprised by the results. ZTC used to produce much smaller .EXEs in much less time than TC++. While BC++ has improved, ZTC times and sizes for V3.0 are virtually unchanged from V2.18. ZTC still wins timings for non-optimised compiles, and sizes for optimised compiles, but the difference isn't as significant as in the past.

Notice the huge difference when the floating point library is included, though. Apparently the Borland float library is very large. The program originally had one function which declared a float, causing both compilers to pull in their libraries. Knowing that function wasn't called in the test program, I told both compilers to ignore floating point. ZTC allowed this, but BC++ gave a link error. I had to comment the function out to get sizes for 'no floating point'.

ZTC is visibly better at optimising Large code, as evidenced by the greater difference between sizes for the L compiles.

Finally, the Z and X program sizes show typical overhead to expect due to linking in a DOS extender. Z model programs also require a separate file (ZPM.EXE) which is 93 KB (I'm not sure how much of that must stay resident).

You'll notice a lack of run-time comparisons. Nearly every test I could create was either meaningless, or spent most of its time in DOS or the run-time library anyway. Timings of most things I tried were nearly the same.

Should I Buy It?

If you already have Zortech V2.x, don't hesitate.

If you have no C++ compiler, and are only interested in Windows Programming, the choice between ZTC and BC++ is a toss-up. ZTC's Z and X model binaries can run under Windows, making the compile-test phase easier, while BC++ has better resource tools. Although the ZTC Developer's Edition is more expensive than BC++, there is a 'Windows + DOS' Edition (sans 386 Extender and binaries) that is cheaper. Don't forget that you'll also need to buy the Windows Function Reference if you buy BC++.

If you need to write DOS programs beyond 640 KB, or do fast 32-bit arithmetic, there is really no choice. I've never seen a better deal in DOS extenders.

EXE

Laine Stump has been a Zortech C++ user for four of the six years he has lived in Turkey. He can be reached by post at: Bilkent University, Lojmanlari 3/9, Bilkent/Ankara, TURKEY, or by modem via the PC Tech BBS (US 612-345-4656, evenings US Time).

Laine was testing the Developer's Edition of Zortech C++, which costs £399.95 + P&P. The C++ Compiler for Windows and DOS that he mentioned is priced at £249.95, and the Science and Engineering Edition, which includes special arithmetical features, costs £599.95. Contact Zortech in London on 081 316 7777.

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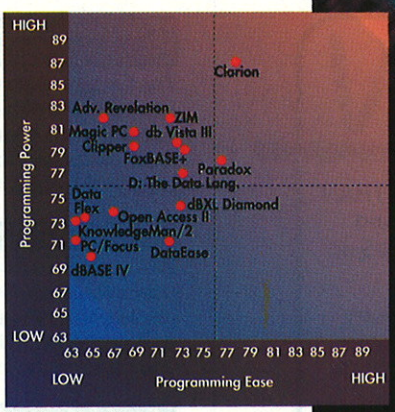

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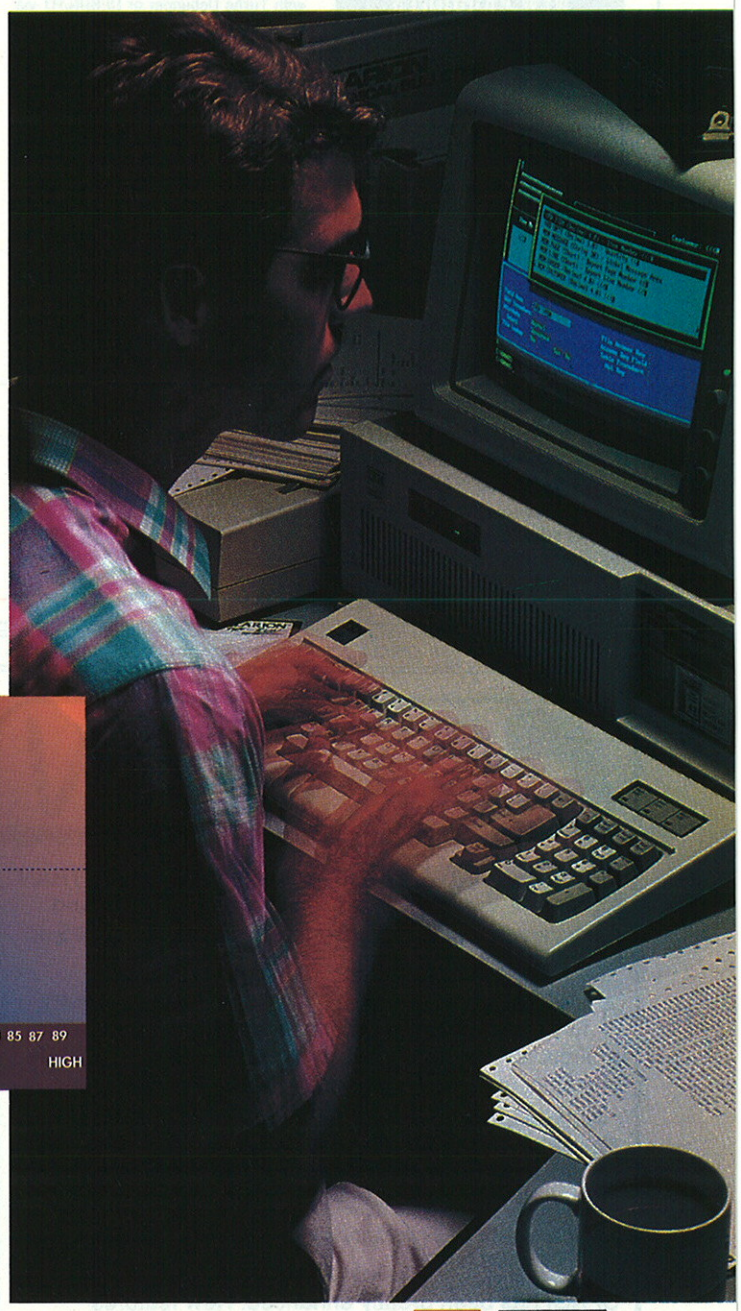

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CIRCLE NO. 291

Expert System shells - Who needs 'em?

When Palle Simonsen became interested in Expert Systems, he baulked at the idea of buying third party specialist software. So here is his simple inference engine - in C.

Is it really necessary to buy an expensive Expert System shell to build production-quality Expert Systems? I say 'no', and this article will explain how to build an efficient but simple inference engine using standard C. For convenience, the inference engine will be referred to throughout this article as 'C-rules'.

C-rules is a library of macros and functions for extending standard 'C' with rule-based programming in the form of 'backward chaining'. My three primary design goals were: 1) to provide a simple and efficient inference engine, 2) to integrate the inference engine, or rather the rule-language it supports, as tightly as possible with the C language and 3) to do so using the features of C to such an extent that a separate preprocessor and/or precompiler would not be necessary. I will leave it to the reader to decide whether these goals have been met.

Before I describe the features of C-rules, a discussion of some of the principles employed will be useful.

Rule-based programming

Traditionally, rule-based programming has mainly been concerned with solving Artificial Intelligence problems in the field of semi-automatic decision systems - so-called 'Expert Systems'.

```
<RULE>       ::= defrule(<Name of Rule>)     <epilogue>
                 IF(<IF-part>) THEN <THEN-part> ELSE     <ELSE-part>
                 end_rule;
 <epilogue>   ::= <statement>
<IF-part>    ::= <expression>
<THEN-part>  ::= <statement>
<ELSE-part>  ::= <statement>

        where <expression> and <statement> are as defined in
          The C Programming Language by Kernighan and Ritchie.
```

Figure 2 - The syntax of a rule

Another extension could be to merge C-rules into C++

A rule-based system usually consists of two components: 1) a rule-base (or knowledge-base) which contains a number of `IF...THEN` statements about the domain of the system, and 2) a database which holds knowledge about the problem being solved.

To solve a given problem, an *inference engine* interprets the rules according to the data in the database, until a given goal-state is reached or until no rules with an IF-part matching the database can be found. The IF-part of the rules may contain code to query the user, search a database, poll external devices etc. The THEN-part may contain code to do various side-effects such as popping-up windows and updating databases.

The inference-engine can work either from the IF-parts of the rules, trying to match them against the database, or from the THEN-part of the rules. In the latter case the rule can be regarded as a logical proposition like A, B, C => D (IF A and B and C THEN D) . In this case the purpose of the inference-engine is to prove the THEN-part of the rule. If other rules have part of the IF-part of a given rule as their THEN-part, the inference-engine recurs to prove these rules as well.

As an example consider the propositions shown in Figure 1. To prove the statement 'The Client is eligible for credit', we will have to prove: 'The Client has a good record of economy', 'The Client has a good job' and 'The Client owns assets'. To prove the latter involves proving one of the propositions:

```
RULE 1:
     'The Client has a good record of economy',
     'The Client has a good job',
     'The Client owns assets'
      => 'The Client is eligible for credit'

RULE 2:
     'The Client owns a yacht' OR
     'The Client owns real-estate' OR
     'The Client owns an expensive car'
     => 'The client owns assets'
```

Figure 1 - Some example propositions

```
IF how=reset
THEN
  reset solved to unknown and return
ELSE
  IF solved != unknown
  THEN
    return status
  ELSE
    execute epilogue
    IF IF-part is true
    THEN
      solved=yes, execute THEN-part
    ELSE
      solved=no, execute ELSE-part
    ENDIF
    return solved
  ENDIF
ENDIF
```

Figure 3 - The logic obeyed by a rule

'The Client owns a yacht', 'The Client owns real-estate' or 'The Client owns an expensive car'. This way of 'chaining' the rules using the THEN-part is called 'Backward Chaining'.

For a further discussion of Artificial Intelligence, Expert Systems and the various problem-solving methodologies employed, please see *Artificial Intelligence* by Elaine Rich, which is a good introductory textbook on the subject.

Backward chaining in C

I chose C as the language of implementation because C offers a useful, albeit crude, facility for language-extension *viz* macros, and because it is supported by efficient compilers on almost any platform.

The syntax of a rule in C-rules is given in Figure 2. It should be noted that the goal in C-rules is the name of the rule, and not part of the THEN part. In C-rules the THEN and ELSE parts serve only as a means for performing side-effects whenever the rule is proven or disproven.

In C-rules every rule is implemented as an `int` function that returns `yes` or `no` (true or false). These rules are implemented by means of macros corresponding to the keywords of the rules' syntax. In order to avoid re-evaluating a rule whose truth has already been established, each rule carries its own state in the form of a `static int` which takes the values `yes`, `no` and `unknown`. A rule takes an argument - `how` - that can take the values `solve` and `reset`. `solve` forces the rule to try to prove itself, `reset` causes it to reset its internal status. The logic which a rule goes through when it is invoked is shown in Figure 3.

To facilitate grouping and resetting of rules, the concept of 'area' has been introduced. An area is a list of pointers to rule-functions spiced up with lists of yes- and no-explanations. Whenever a rule is invoked for the first time, it will add itself to the rule-list of the current area. RULES.H, which is shown in Figure 4, includes the macros used to implement this approach. Figure 5, C-RULES.C, contains the supporting functions. Finally, Figure 6 contains an example of a simplistic credit evaluation application in C-rules.

Is it really necessary to buy an expensive shell to build production-quality Expert Systems? No!

As a software-engineering technique, rules-based programming has a utility that extends beyond the scope of its traditional use as the representation of domain-knowledge in Expert Systems. Among the possible applications are checking of various consistency rules in traditional administrative applications, and user interface control in event-driven systems such as X and Microsoft Windows. However, for obvious reasons none of these applications justify the employment of a traditional expert-system shell. Something different is needed.

An attractive approach is to use a 'language-extension' such as C-rules. There are various benefits. C-rules can be implemented and enhanced by anyone with programming experience in C, and thus requires no runtime licensing; as explained below, it can be expanded to provide modelling power comparative to Prolog and because it is written in C, it can be embedded within any application, except those which must be written in assembler - rare enough these days.

The apparent drawbacks are the lack of supporting environments such as dedicated editors and interpreters found in commercial Expert System Shells and, of course, the limitations imposed by using C's primitive macro facility. However, as C programming environments are becoming more and more advanced, with programmable editors, source-code browsers and source-level debuggers etc the problem with the environment support might not be so prohibitive. Another, perhaps more serious, limitation in C-rules is that it currently does not support that more than one proposition leads to the same conclusion (eg A,B => C and F,H => C). If this is the case the rules have to be rewritten: (A,B) or (F,H) => C.

Extensions

An obvious extension to C-rules is to allow the rules to take arguments, in a sense expanding the language from propositional to predicate calculus as supported by Prolog. Another extension could be to merge

```
/*  R U L E S . H
 */


/* Constants */

#define solve    0
#define reset    1

#define yes      1
#define no       0
#define unknown  2

#define MAX 100

/* Types */

typedef int (*PFI)();


/* AREA */

typedef    struct area {
 char      short_name[32];
 char      pretty_name[128];
 char      yes_expl[MAX][128];
 int       n_yes_expl;
 char      no_expl[MAX][128];
 int       n_no_expl;
 int       number_of_rules;
 PFI       rules[MAX];
} AREA;


/* DEFRULE Macros  */

#define defrule(name) \
int name(int); \
 int name(int how) { \
   static int solved=unknown; \
   static int firsttime=yes; \
   if(firsttime==yes){firsttime=no;\
                 put_rule(name);}; \
   if(how==reset){ \
 solved=unknown; \
 return(solved);};\
   if (solved != unknown)\
 return(solved);


#define IF   if ((how==solve &&\
solved==unknown) &&
#define THEN ){solved=yes;
#define ELSE }else{solved=no;
#define end_rule }; return(solved);}

/* Prototype for simple Yes/No input
fn */
int get_yn (char *question);
```

Figure 4 - C-Rules header RULES.H

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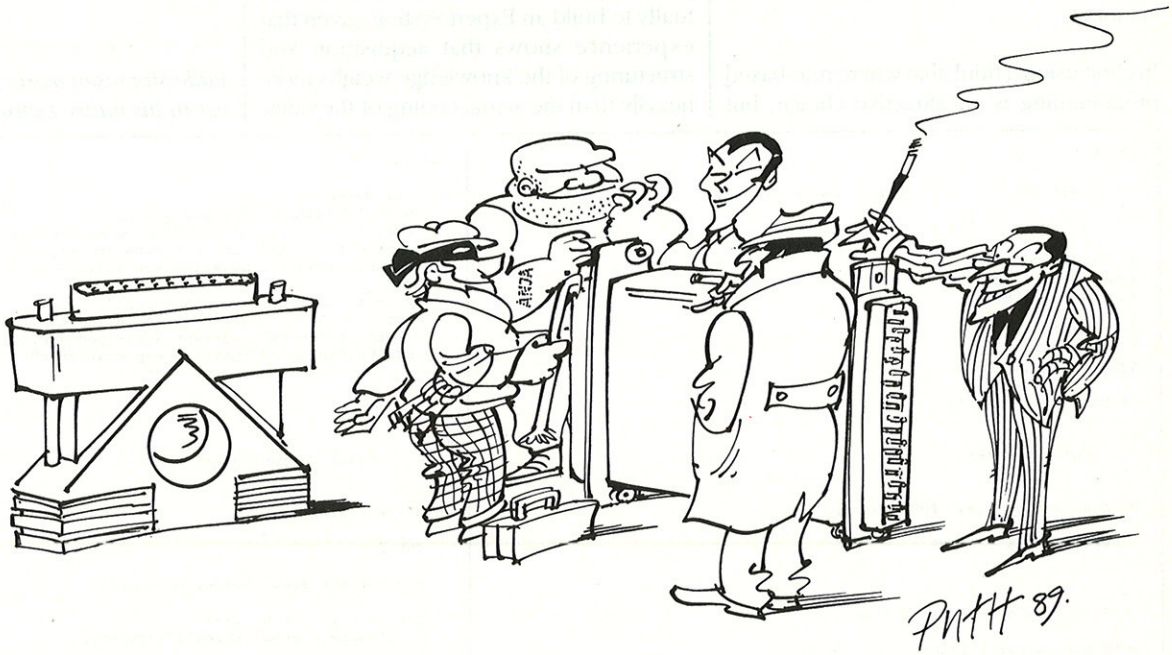

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C-rules into C++ in such a way that a class would know the rules applicable to it. Such a class could be used to implement forward chaining.

In conclusion, I think that where rule-based programming is an attractive choice, but the costs of an Expert System shell is prohibitive, a tool like the C-rules library might provide the solution. When the task is actually to build an Expert System, given that experience shows that acquisition and structuring of the knowledge weighs more heavily than the actual coding of the rules, it might still be worth considering C-rules or something similar.

EXE

Palle Simonsen works as a software engineer in his native Denmark.

```
/*  R U L E S
 *
 *  Copyright (C) 1990, 1991 - Palle Simonsen
 *
 */

#include<stdio.h>
#include<string.h>
#include "rules.h"

/* Globals */

AREA *current_area;

/* Help functions */

/*
 *  Subscribe AREA
 */

void subscribe_area (AREA *area)
{
  current_area = area;
}

/*
 * Save a rule in current area
 */
void put_rule(PFI rule)
{
    current_area->rules[current_area->number_of_rules] = rule;
    current_area->number_of_rules++;
}

/*
 *      Explain functions
 */

void put_yes(char expl[128])
{
  strcpy(current_area->yes_expl[current_area->n_yes_expl++],expl);
};

void put_no(char expl[128])
{
  strcpy(current_area->no_expl[current_area->n_no_expl++],expl);
};

void display_explain(int kind)
{
  int i;

  if (kind==no) {
     printf("\nNegative explanation:");
     for (i = 0; i < current_area->n_no_expl; i++)
       printf("\n %s", current_area->no_expl[i]);
     printf("\nEnd of negative explanation\n");
  }else{
     printf("\nPositive explanation:");
     for (i = 0; i < current_area->n_yes_expl; i++)
       printf("\n %s", current_area->yes_expl[i]);
     printf("\nEnd of positive explanation\n");
  }
};


/*
 *      Reset Current area
 */

void reset_area ()
{
   int i,n;

   n = current_area->number_of_rules;

   for (i = 0; i < n; i++)
      (*current_area->rules[i])(reset);

   current_area->n_no_expl  = 0;
   current_area->n_yes_expl = 0;

};


/*
 *  I/O Support for C-Rules
 */


int get_yn (char question[])
/* Pose a yn question */
{
  char response;
  fflush( stdin );
  printf("%s\n> ", question);
  scanf("%c", &response);
  if (response == 'y' || response == 'Y')
     return(1); else
     return(0);
};
```

Figure 5 - C-RULES.C

```
/* Test case for C-Rules */

#include "rules.h"

defrule (GoodEconomy)
 IF get_yn ("Does the client have a good record of economy?")
   THEN
       put_yes ("The client has a good record of economy");
   ELSE
       put_no("The client does NOT have a good record of economy");
end_rule;

defrule (GoodJob)
 IF get_yn ("Does the client have a good job?")
   THEN
       put_yes ("The client has a good job");
   ELSE
       put_no("The client does NOT have a good job");
end_rule;

defrule (OwnsAssets)
 IF (get_yn ("Does the client own real estate?") ||
       get_yn ("Does the client own an expensive car?") ||
       get_yn ("Does the client own a yacht?"))
   THEN
       put_yes ("The client owns assets");
   ELSE
       put_no("The client does NOT own assets");
end_rule;

defrule (BadPayer)
 IF get_yn ("Is the client registered as a bad payer?")
   THEN
       put_no ("The client is registered as a bad payer");
   ELSE
       put_yes("The client is NOT registered as a bad payer");
end_rule;

defrule (CreditWorthy)
 IF (GoodEconomy(solve) &&
       GoodJob(solve)       &&
       OwnsAssets(solve)    &&
       !BadPayer(solve))
   THEN
       printf("\n\nRESULT: The client is eligible for credit");
       display_explain(yes);
   ELSE
       printf("\n\nRESULT: The client is NOT eligible for credit");
       display_explain(no);
end_rule;

static AREA credit;

void main ()
{
  /* Setup credit */

  strcpy(credit.short_name,"Credit");
  strcpy(credit.pretty_name,"Credit - level 1 check");
  credit.n_yes_expl = 0;
  credit.n_no_expl = 0;
  credit.number_of_rules = 0;
  subscribe_area(credit);      /* Make 'credit' the current area */

  /* Test C-Rules */

  CreditWorthy(solve);
};
```

Figure 6 - Test of C-rules

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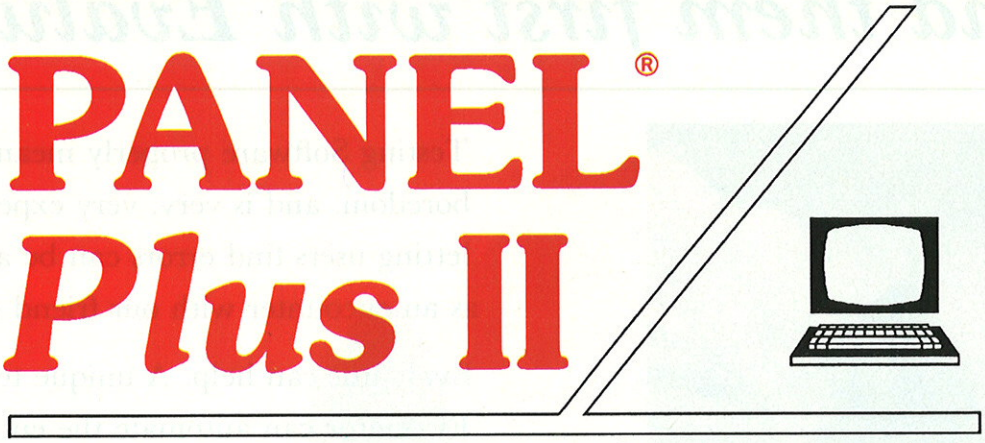

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FoxPro in the mainstream

What with Borland/Ashton-Tate merger, and the increasingly independent Clipper, the waters of the xBASE market are well muddied. Bob Rimmington finds out what Fox has been up to.

Visually, the new FoxPro 2.0 looks little different to V1.0 - but lurking below the surface is a major upgrade. The xBASE language is still there, though with many additions, but much of the rest is new. There is a complete project builder with menu, screen and report design tools, a new Relational Query tool, enhanced and alternate index formats, SQL support and the Rushmoor superfast query optimisation technique.

It is a big package, filling from six to ten megabytes of disk space, depending on installation options. It will run in 512 KB of memory, but prefers over 2 MB for best performance. The eight manuals and booklets total around 2700 pages - and this is just for the standard (LAN) version supplied for review. There are additional packages for the Run-time engine (plus .EXE compiler) and for the API Library Construction Kit. The former, alone, will claim another two to eight megabytes of space.

Several years ago the xBASE world consisted of the market leader, Ashton Tate's dBASE III Plus, and various clones such as Fox. A program written for one would normally run in the others with little or no alteration. Not so today. Nantucket is increasingly ploughing its own path as Clipper moves towards C and OOP. Along what might be called the main stream of development, Fox is now in the lead and making all the running. Just what Borland will do about dBASE IV, if anything, we have yet to see.

Make your preconceptions about FoxPro 2's screen generator AFTER you see the software

Basic Features

Installation runs so smoothly it is not worth describing. There is no copy protection as such, but unique serial and activation codes must be entered and, presumably, could identify a 'loaned' copy.

A complete review of V1.0 was published in .EXE in February 1990. The basic user interface has changed little; it is based on a windows-type environment but text rather than graphics based. This works well (though the default colour scheme suggests that Fox was last in the queue when colour combinations were being handed out) but is now looking dated. When V1.0 was released we were still with Windows 2.1 and using it mainly for graphics and DTP applications. We accepted that most other software, especially databases, would have their own individual appearance. Windows 3.0 has changed the rules - it is becoming a standard. A look-alike that does not quite work-alike is an irritation. Mind you, being text based, FoxPro does run much faster.

A debatable feature is the extensive use of a mouse. The latter is not necessary but makes many operations easier and more intuitive. This is fine at the design stage but more questionable with a finished application. Users become very adept at fast entry of data from a keyboard. Switching to the mouse for check boxes, buttons and pop-ups could become quite irritating and unproductive.

Interestingly, I could not find a reference in the documentation about running in MS Windows 3.0, nor is a .PIF file supplied. It *will* run, but only in Standard mode. Attempting to run the Extended Memory version produces an 'Incompatible Memory Manager' message.

Screen Tools

The initial screen comprises the customary top menu bar and a small 'Command Line' window. This basic user interface can be used in three ways. First, as an interactive

RUSHMOOR TECHNOLOGY

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AVERAGE	COPY TO	DISPLAY	LIST	REPLACE	SORT
BROWSE	COPY TO ARRAY	EDIT	LOCATE	REPORT	SUM
CALCULATE	COUNT	EXPORT	RECALL	SCAN	TOTAL
CHANGE	DELETE	LABEL			

Combining Basic Expressions

Basic Expression	Operator	Basic Expression	Query Result
Optimisable	AND	Optimisable	Fully Optimisable
Optimisable	OR	Optimisable	Fully Optimisable
Optimisable	AND	Not Optimisable	Partially Optimisable
Optimisable	OR	Not Optimisable	Not Optimisable
Not Optimisable	AND	Not Optimisable	Not Optimisable
Not Optimisable	OR	Not Optimisable	Not Optimisable
	NOT	Optimisable	Fully Optimisable
	NOT	Not Optimisable	Not Optimisable

Figure 1 - Rushmoor Technology

tool for creating databases, entering data and looking at files. Few if any packages do this better. The basic tools are straightforward to use, the facilities extensive and the performance first class. By implication, it is suitable for a first time user and I was able to show it to several of these. They liked the appearance, but I have to say that they were all discouraged by the sheer scope and flexibility. Conversely, those with more experience were delighted at the power available.

The second use is access to the tools for building one's programs or, to use Fox terminology, one's project. These comprise screen, menu, query, report and label design tools. All are completely new or enhanced for V2.0 and can be used to create complex applications with relatively little hand coding. An overall project tool enables all the separate elements to be brought together into one cohesive whole.

The final use is selective incorporation into one's own project. Each option in the menu PAD (the top menu bar) and menu POPUP (the drop-down menus) has a unique system name for the facilities it calls and the programmer can use that rather than write his own code. For example, a 'Save' option could call _MFI_SAVE or a 'Calculator' option _MST_CALCU.

Screen Generator

Programmers can still write source code either in their own editor or in the quite acceptable one provided. With around 600 commands and functions (90 new and 40 enhanced for V2.0) there is ample scope. This probably remains the best way for the really complex applications. However, the application generator tools are definitely worth a look. Take the screen builder, which is far more than just a layout designer. Picture, colour and `VALID` clauses can be specified, also pick lists, push buttons, radio button and check lists. There can be pop up windows, dialog boxes, alternate menus, all conditional if required on entries by the user. One look at the generated code is enough to demonstrate the time it can save.

Screen generators are not a new idea - there was even a very simple one which came with dBASE II - but for FoxPro 2 you should make your preconceptions *after* you have seen the software. There is scope to include 'code snippets' while designing the screen, also to include calls to procedures or user functions for any really tricky bits. A 'Screen' can comprise a set of linked screens or windows and include Utility screens (such as brief menus) common to other applications. The created file has a .SCX extension, it generates an .SPR xBASE code file which is compiled to a .SPX file. There are similar sets of files for menus, reports and queries.

Fox warns against hand tweaking the .SPR code file and suggests editing is always applied to the .SCX screen. This may be feasible where the screen serves the normal role of data entry or amendment. However,

Rushmore is one of those clever ideas that leaves one wondering why no one had thought of it before

there are users with interactive needs which not even Fox has anticipated, and for these it is a case of 'back to hand-coding' with an ASCII editor.

Relational QBE

FoxPro 2 contains a new RQBE (Relational Query By Example) tool based on an optimisation technique called Rushmoor. xBASE programmers will know that a conditional search using the `FOR ...` construct on a large database can be very slow. Where the criteria is specified at programming time, the delay can be minimised with a combination of indexed file, `SEEK` for the first record and a `DO WHILE ...` loop to find the remainder. However, where the conditions are complex, coding may not be easy and, in any case, user flexibility is restricted.

The trick with Rushmoor is that it appears to write that code for you on the fly. No additional commands are required (unless it has previously been disabled), it just works automatically with any command that accepts a `FOR ...` clause such as `BROWSE`, `COUNT` or `REPLACE`. It will apply if the criteria would work using `SEEK` on an indexed file (it will even create that index on the fly), including complex expressions. For example, `BROWSE FOR NAME = 'Smith' .AND. TOWN = 'Leeds'`. It will not work on `BROWSE FOR NAME = 'Smith' .OR. 'ith' $ NAME` as every record would need to be examined for the second test. It may even breath life into `SET FILTER TO ...`, usually the xBASE equivalent of a change to bottom gear.

Rushmoor is one of those clever ideas that once seen leaves one wondering why no one had thought of it before. Fox has demonstrated near instant searches on a million record, 200 MB database - although I have not been able to verify this with my own modest hardware setup. Amidst the euphoria it is necessary to remember that it will not optimise all queries. If the test cannot be applied to an index, or the index is conditional or too complex, a time consuming look at each record is still required. For example, it would not have worked on a 4000 record file of paper colours that my client required in alphabetical order, providing all colours including the word 'White' came first. It may be possible in such cases to add dummy fields and indexes that would meet the Rushmoor rules. These are clearly explained and tabulated in the documentation - see Figure 1.

The RQBE entry screen itself makes the entry of even quite complex queries just about as easy as is possible with this kind of task. A logic pick-list of phrases such as 'like', 'more than', 'between' is used to identify the actual underlying operators and works in conjunction with a 'NOT' check box. Queries in fact write SQL code in the Command window, (a handy way of getting to know it), and can be saved for subsequent reuse or for pasting directly into a program. - a nice touch. Output for the query can be to screen, printer, file, report, labels, array variables or the optional FoxGraph add-on.

Other Tools

To access all these facilities there is, naturally, a Menu tool. With this, a full Windows-type menu structure can be built including all the familiar features such as hierarchical popups, logically inhibited options and short-cut key combinations. There is also provision for separate 'Quick' menus of any size or position. The Report Writer is similar to V1.0 but with various enhancements. It is of the familiar header/detail/footer bands type and is straightforward in use. It can access any data file and these do not necessarily have to be related. (An irritating restriction with R&R Report Writer). Unfortunately it does suffer from the text-based being a rather than true GUI environment. Page size is specified in lines, line length in characters. So it is of little help when variable or proportional font sizes are required.

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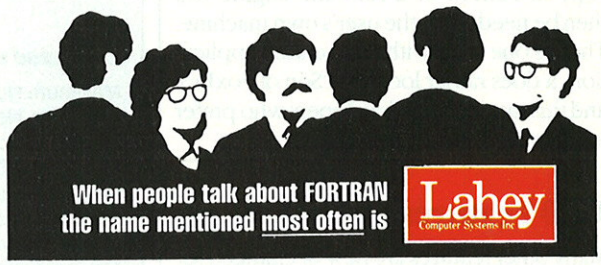

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Windows 3!

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The specification for a report is saved in a database file with a .FRX extension. All the other tools generate a normal source code or 'Program' file including a header and other comment lines. The Program files are, in turn, written to a 'compiled' format before they can be run with the normal DO command. A large application can clearly comprise a considerable number of files with, in effect, three versions of each. The project builder is used to control this as well as all the associated data, index and similar files. For the client, a single .APP file can be produced for the complete application. As the code is only compiled, not linked, a copy of FoxPro or a run-time engine will then be needed on the user's own machine. There's one snag with a generated application, it does rather look like 'Son of FoxPro' and this may not suit developers who prefer to maintain their own style.

V2.0 Features

Many other features are new or changed for V2.0. The number of open indexes and windows and the length of variable strings is now only limited by memory. The maximum command line length is up from 1024 to 2048 bytes. An External Routine API is available in a separate Library Construction Kit but be warned, it has to be used with Watcom C. There are so many command and function enhancements that only a few can be mentioned. `@...EDIT...` creates a region for editing text such as a string or memo field. Arrays can be redimensioned without data loss. IMPORT takes data from various worksheet and other file formats and places it in a .DBF file. `SET SKIP TO [<alias1>[,<alias2>]...]` forces the SKIP command to work through each matching record in a related, child database. (Ideal for an item line file linked to an invoice header file).

UDFs can now be used in `FOR`, `WHILE` and `INDEX` expressions. There are ten new array functions. `EVALUATE()` will evaluate a character expression and provides a faster alternative to the & macro substitution in many cases. Three SQL commands are now included: `SELECT`, `CREATE TABLE` and `INSERT`. They are not in a separate 'Mode', but can be used alongside all normal commands or generated with the RQBE interface.

Four index formats are now available. The previous single entry .IDX format remains for compatibility and can now also be specified in compressed format. A new compound .CDX format can contain any number of separate index entries or `TAG`s. If defined as a `STRUCTURAL` type it will take the same name as the database and be opened automatically with it. The `INDEPENDENT` type must have a different name and can be opened and closed as required. All .CDX files are compressed and are now the recommended format.

The excellent FOXDOC is still included. It is the public domain SNAP! documenting package tailored to fit FoxPro 2.0 and, in fact, its author has now joined Fox. All generated programs are in SNAP! style.

Fox has always had a reputation for fast program execution and claims further speed improvements for V2.0 including access to data 'up to hundreds of times faster'. Performance comparisons are not really valid now that languages have diverged so much. It would be necessary to find a common task and write optimised code for each package. Yet even that might be testing the code as much as the software itself. FoxPro certainly seems fast, quicker than dBASE

FOXPRO 2.0 - SYSTEM CAPACITIES

	FoxPro	*FoxPro Extended*
Database and Index Files		
Maximum No. of records per database file	1 billion	1 billion
Maximum No. of characters per record	4000	4000
Maximum No. of fields per record	255	255
Maximum No. of databases open at one time	25	25
Maximum No. of characters per database field	254	254
Maximum No. of characters per index key (.IDX)	100	100
Maximum No. of characters per index key (.CDX)	254	254
Maximum No. of open index files per database	unlimited	unlimited
Maximum No. of open indexes in all work areas	unlimited	unlimited
Field Characteristics		
Maximum size of character fields	254	254
Maximum size of numeric (and float) fields	20	20
Maximum No. of characters in field names	10	10
Digits of precision in numeric computations	16	16
Memory Variables and Arrays		
Default No. of memory variables	256	256
Maximum No. of memory variables	3600	65000
Maximum No. of arrays	3600	65000
Maximum No. of elements per array	3600	65000
Program and Procedure Files		
Maximum No. of lines in source program files	unlimited	unlimited
Maximum size of compiled program modules	64KB	64KB
Maximum No. of procedures per file	unlimited	unlimited
Maximum No. of nested DO calls	32	32
Maximum No. of READ nesting levels	4	4
Maximum No. of structured programming commands	64	64
Report Writer Capacities		
Maximum No. of objects in a report definition	unlimited	unlimited
Maximum No. of lines in a report definition	255	255
Maximum No. of grouping levels	20	20
Window Support		
Maximum No. of open windows (all types)	unlimited	unlimited
Maximum No. of open Browse windows	20	20
Miscellaneous Capacities		
Maximum No. of characters per character string	64KB	2 gigabytes
Maximum No. of characters per command line	2048	2048
Maximum No. of open files	99	DOS limit
Maximum keystrokes in keyboard macro	1024	1024
Maximum fields in a SQL SELECT statement	256	256
Colour Support		
Number of colour schemes per colour set	24	24
Maximum No. of colour sets (in FOXUSER file)	unlimited	unlimited
Number of colours per colour scheme	10	10
Schemes available for user definition	8	8

Figure 2 - FoxPro 2.0 System Capacities

System Science

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CIRCLE NO. 298

certainly, and similar to Clipper at handling menus and user entry screens. Where it really sprints is at indexing and queries.

Documentation

The sheer size of the documentation is rather daunting but it is comprehensive and well organised. A massive reference volume of all the commands and functions, an interface guide, a developers guide, a good tutorial and various other booklets are supplied. It takes time to find your way about though. Instead of the usual README file on disk, there is a 'Late breaking News' booklet (90 pages). Not only is this far better than a print of a disk file but another excellent 'Master Index' booklet included references to all those extras. So I'll give nine out of ten marks to Fox for Docs - one mark deducted for corrections to the Tutorial Guide, which are buried in the Help system.

It is interesting to compare the definitions of identical functions in dBASE IV, FoxPro and Clipper. dBASE is clear, rather bland and with generally brief examples. Fox goes for a readable, 'in your own words' style with good examples. Clipper is more formal with precise notes, fuller details and again good examples. There is no clear winner here but Fox does score bonus points with its excellent guides to the various project tools and other facilities. The detailed data on all the file types is also very welcome. The tutorial takes user friendly all the way, eg 'cos it's as empty as a gas tank the day before pay day'. We can all recognise that problem!

The on-line help is extensive. It is context sensitive but with access to a topics index and a 'See Also' box. It can be tailored in various ways or adapted for your own application. The overall structure and design is first class yet I found it less satisfactory in use. The command and function definitions were fine but notes on the various tools were often too superficial and reference had to be made to the printed manuals for the full story.

FoxPro V2.0 is huge. It contains too many features for all to be described in the confines of a review. So regretfully I can merely note that there is a debugging facility, an error trapping system, a flexible memo field size, multi-user commands and a virtual memory management system. The size itself is a problem though. I was able to try it on an old 512 KB XT. Yes, it did work, slowish but acceptable. The trouble was the disk space. The complete package will not fit into a 10 MB disk and to run at all, it needs over half that space. For such old boxes a cut-down version (or V1.0) makes more sense. For system capacities see Figure 2.

Distribution Kit

An optional Distribution Kit (£345 extra) provides three ways of running your application on other machines. Your ordinary (ie tokenised) file can be used with a run-time 'engine'. A compact .EXE file can be created for use in conjunction with supporting Library files. Finally, a stand-alone .EXE file can be created. Various problems were found with both of the latter and in practice only fairly simple programs compiled first time. Even a four line 'Hello World' program failed initially with an error message showing an indecipherable line from the tokenised file. Not very clever. Yet the same code in a fresh .PRG file was accepted and created a 742819 byte executable. Is this a record?

The dBFlex Accounts package was used as an example of a typical application. It comprised about 110 program files totalling 2Mb of xBASE code without any Fox-specific-functions. It ran very well in the standard and run-time modes but revealed an apparent limitation in the .EXE builder. Called programs and UDFs were not consistently processed, especially if not in the initial or 'header' .PRG file. Other nested ones were listed as errors. The best attempt missed only a few UDFs but hand tweaking was needed to include these. The now complete .EXE file was 2158445 bytes in size (there were also 1358323 bytes of project files) and took seven minutes to compile and link. By comparison a Clipper .EXE was 786041, took three minutes and included all UDFs.

No incremental link facility is provided. There is no mention of overlays, but the 2 MB file did appear to load and run in a 550 KB DOS 'Window'. The various tests suggested that the .EXE builder is not yet of the same quality as the rest of the package.

Final Conclusion

So what is the overall verdict? There is no doubt that FoxPro 2.0 is a fine product. It should delight existing Fox users and attract many new ones. It is very fully featured, fast and powerful. It is well documented, has a solid, well tested feel and is as easy to use as such a sophisticated product could be. Will it convert the writer, a long-standing Clipper user? Possibly not. Both languages are now very extensive but increasingly different. So it would take time to learn new tricks and replace an extensive personal UDF library of screen, menu and other templates. Also: why should I have to pay extra to provide clients with stand-alone .EXE files?

However a more relevant question today is which, out of Fox or Clipper, is best for those frustrated by the limitations of dBASE? It is difficult decision. They are both good though with differing strengths and weaknesses. Many will be attracted by the apparently easier migration path of Fox. They will not be disappointed. It is especially ideal for corporates, where users are pressing for freedom to handle their own data but a potential proliferation of DIY programmers conflicts with company po

EXE

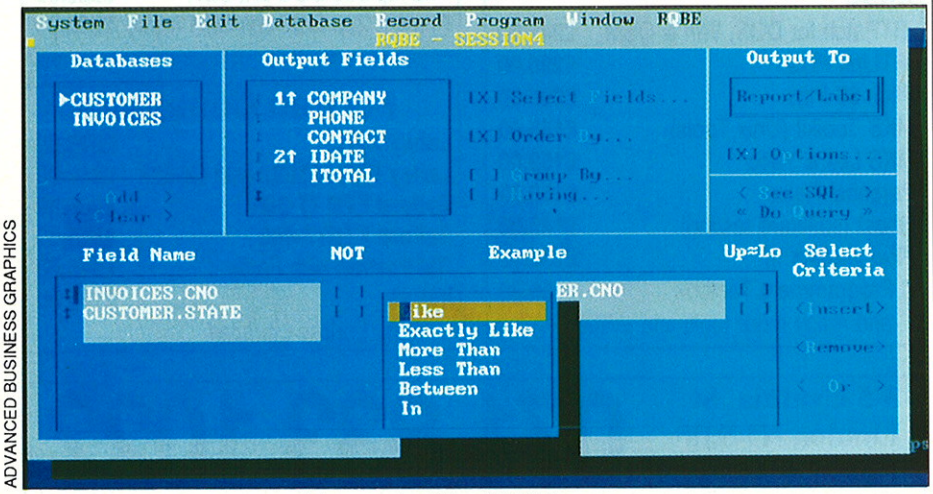

Figure 3 - The RQBE screen

ADVANCED BUSINESS GRAPHICS

Bob Rimmington is an independent xBASE and Clipper consultant. He can be contacted through Stanford Systems on 0444 236352. The single user FoxPro 2.0 is priced at £595, the LAN version (as tested) at £895 and the Distribution Kit (for Run-time and .EXE files) is £345 extra.

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CIRCLE NO. 299

Free for all

American company EMS compiles and markets an extensive range of professional shareware libraries. Paul Kemp has been taking a look at the latest C++ offering.

The electronic bulletin boards and computer mags are swimming in the stuff. There seems to be no shortage of enthusiastic programmers, eager to bare their naked code for all the world to see. Understandably proud of a particularly elegant or innovative piece of code, some programmers just can't resist letting other people in on their secrets. Of course this does not always reflect a genuine and general altruism in the programming community - some utilities are offered as a tantalisingly cut-down version that can be upgraded at a price. The quality of public domain software varies enormously; from the utterly worthless to the real bargain. EMS has tried to separate the wheat from the chaff and aims to provide a comprehensive collection of the cream of what is on offer.

What you get

The C++ Utility Library comprises 90 PD/shareware utilities in compressed (.ZIP) format, loaded onto 12 disks. In addition, there is a directory diskette that contains a database (dBASE III+ compatible .DBF) which fully documents the utilities supplied. A simple lookup program for use with this database, along with a copy of PKUNZIP are also provided. Not only are all the utilities in the library documented, but the directory also holds information on 17 major C++ toolkits and utilities that are available commercially (eg application frameworks, class libraries, code generators, browsers etc).

The lookup program enables the user to locate utilities in the library by name, type or simply by browsing through the whole list. Information includes the name of the utility, its disk number, type, a brief description and a contact address. Once located, the compressed file can be unzipped onto your hard drive from the appropriate library diskette. A list of the C++ utility types included in the EMS library is tabled in Figure 1.

Highs and Lows

Obviously there are far too many utilities in the library for me to go into detail here, so I shall just give a brief overview. I think it is important at this point to distinguish between utilities that are supplied with source code and those that come precompiled. To my mind, without source, these utilities are nigh on useless, unless they are of an extremely high quality and well documented. Happily, most of the programs in the EMS library do come with full source.

It seems that the most interesting and useful programs are often the simplest. For instance, the numerous implementations of string, date and time classes provide an excellent starting point for developing one's own versions of these objects. Comparing alternate implementations facilitates design by making it easy to 'mix and match'. This is true for many of the other class types (eg memory management, containers etc) listed as well.

There is a great breadth of programming topics covered in the library; from tutorials and hypertext help for C++ beginners, up to highly complex virtual memory and comms classes. Some of the material presented though cannot really be called shareware. It consists of compiler bug lists, patch files, tutorials and even a C++ quiz! I didn't find the tutorials particularly helpful and they are in no way a replacement for a good book. The more complex class implementations that are given warrant careful perusal and may be enlightening to programmers working in a specific area. However, some of the examples are rather half-baked and others just don't work properly at all.

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Code Analysis	Memory Management
Serial communications	Printer
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Date/Time	Streams
Debugging	String
Graphics	Tutorial
Linker	User Interface

Figure 1 - C++ utility types

Conclusion

I have to confess to harbouring mixed feelings on the whole subject of shareware utilities. Yes, it's great that developers can have access to programs written by someone else, thus extending the concept of code reuse beyond company boundaries. But on the other hand, is it actually of any real use, valuable merely as an interesting distraction? It certainly does no harm to be in possession of a good library of relevant shareware, that can be dipped into on occasion for reference. If you feel that this is a good idea, then you will certainly benefit from this library. After all, it is well documented, up-to-date and probably much cheaper to purchase than whiling away hours, scanning bulletin boards and swelling the coffers of British Telecom. Also, if you don't have access to BBSs, it is practically the only way you're going to get a reasonable collection of public domain utilities. If, like me, you feel that you can probably live quite happily without most shareware, but want to keep in touch 'just in case', the EMS library is not a bad place to start.

EXE

The C++ Utility Library from EMS costs $49.50 + $20 p&p. For information about other shareware libraries or to order, contact EMS at 4505 Buckhurst Ct, Olney, MD 20832, USA. Tel: 010 1 3019243594 or Fax: 010 1 3019632708.

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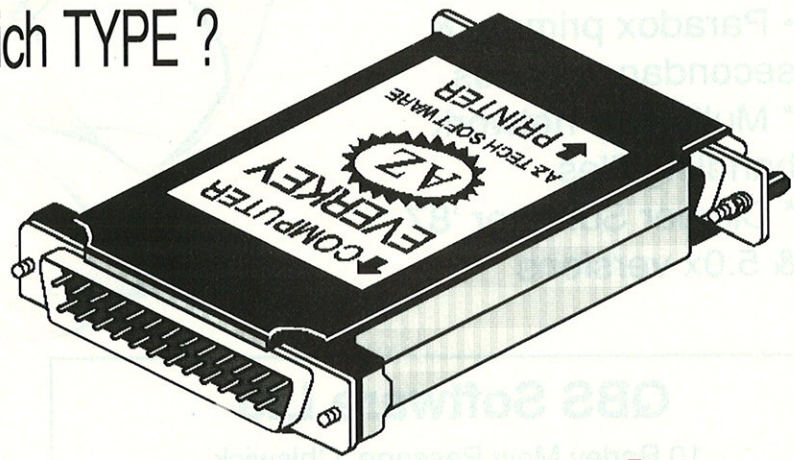

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The Law is an ass

Jules wants computers to be controlled by legislation, but he wants the laws to be informed and useful.

The computer revolution that was promised us is almost over. Fifteen years ago, journalists were writing articles with titles like 'Chips with everything', promising that people would forget how to use pens, and mass unemployment would be rampant. (Well, we've had mass unemployment, but it wasn't the computers' fault!) Ten years ago, the balance started to shift. In one sense, the challenge of the last decade has been to get computers onto people's desks, where they can make use of them.

That market is saturated now; practically everyone who wants a computer has one. The 90's needs a new challenge to solve - a new byword with which to sell computers, and that byword is 'connectivity'. From now on, a computer on your desk will not be enough, it will have to talk seamlessly to all the other computers in the office, and elsewhere in the organisation. Radio, telephone, and PSS connections will become commonplace, and what is more they will work.

Now, it seems to me that the upheavals promised by the journalists all that time ago are about to be unleashed. But it won't be people not understanding the technology which does the damage, nor will it be a loss of control on the stock markets. No, the damage will be done by the legislators who think that if ignoring problems doesn't make them go away, massive over-reaction will.

This was the problem with motor cars when they appeared. At first, driving involved constant maintenance, and it was usually quicker to walk anyway. As cars became more reliable, and more people started driving, the general public became worried about their noise frightening horses, or people driving so fast they asphyxiated themselves at the wheel. A series of ever more idiotic laws followed, until eventually a comprehensive vehicle licensing scheme was introduced, the revenue from which was ploughed back into the road infrastructure. Finally, we have a body of legislation about cars which, in the main, is sensible and efficient.

When computers start talking to each other on a large scale, I think similar things are going to happen. There will be a few accidents, most caused by sheer ignorance or the immaturity of the technology, and idiotic legislation will follow.

We have the beginnings of that legislation now, in two acts. The first is the Data Protection act. In principle this is a very well-intentioned law. Everyone who keeps data about you must register, and you can apply to the holder to see your records. In practice, this is probably the most toothless law ever enacted. It costs (a maximum of) £14 to see your record, and the payment must be made for each and every record you wish to see, even if they are held in one computer. The registrar cannot tell you where to ask, so you must have the name of the organisation before you can make the application. Many databases are excluded from scrutiny, such as police or medical records, and partial records (from which you can't be identified) or paper records (not held on computer) do not count.

People were frightened by their computer files, which is why the law was passed of course. Nevertheless, the law has been practically useless. One company, who introduced an entire department to deal with the expected flood of enquiries, received only two requests in the first year!

The DPA is well-intentioned, but useless. The other act is far from useless, it is downright damaging. This is the new hacking law. Under this law, someone who gains unauthorised access to a computer can receive a sentence of up to five years, even if he has intended and done no damage. This makes trespass equivalent to possession of class A drugs! On the other hand, there's no such thing as criminal damage to computer data, or embezzlement, so someone who uses his authorisation to destroy information risks no legal penalty at all, in spite of the fact that an employee who puts his fist through the screen in exasperation can go to prison! The thing that occurs to me is that, if you leave your house with the key in the front door, and someone uses the key to get into your house to steal your TV, it's your silly fault. Apparently, if your password becomes public, the same principle does not apply - you are the victim of a network attack (as the security people so delicately put it). System builders are looking to the law to protect them from their own inefficient security, and the law is clobbering the wrong people.

What we need is solid, sensible, effective legislation. We need to build the data transport infrastructure on which the networks will be based, we need to build in safety standards so equipment doesn't wreck that infrastructure and other people's data, we need security standards to restrict access (and freedom laws to ensure it), and finally we need conventions and etiquette (like the highway code) to keep the whole thing running smoothly. All this is bound to come about sooner or later, but it can come easy or it can come difficult. As the pace of technology is speeding up, the pace of the legislature is slowing down, and no-one seems to be aware of the crisis that is developing. It's only a matter of time before we get computer gridlock.

We are constantly told that we are living in the information age. One day, we will be.

EXE

Jules May knows little about law (bet you never thought he'd admit that!), but watches it with increasing incredulity. He can be contacted on CIX as jules, or on 0707 44185.

The Typeless Survivor

In the growing trend to ever stricter typing, why is typelessness such an advantage for BCPL? Martin Richards, inventor of this forerunner of C, explores the issues.

BCPL (Basic CPL) is an idiosyncratic programming language which is both loved and hated by those who come across it. It was designed in 1967 as a portable systems programming language and is still in use today, even without the backing of an ANSI standard or the support of a Multi National. It owes much to the older language CPL (Combined Programming Language) which was worked on from 1962 to 1967, but has survived much longer than its progenitor, probably due to the combination of its simplicity and its easy portability. The simplicity results mainly from its enthusiastic adherence to typelessness, but this is also its main source of criticism.

In an interview published in *.EXE* (February 1991), Dennis Ritchie described how B developed from BCPL and later evolved into C by the addition of data types to improve the handling of characters, machine words, floating point numbers and structures. Following the modern trend towards ever stricter type-checking, C has now developed into ANSI Standard C - almost universally regarded as a step forward. By bucking this trend, BCPL has become one of the very few typeless languages that still exists. This article attempts to show that typelessness is sometimes a great asset, and not necessarily the disaster in terms of efficiency, readability and debuggability that some critics suggest. Readers are invited to re-code some of these examples in their own favourite languages for comparison. Those choosing C will follow in the footsteps of Ritchie, and appreciate for themselves the effect of adding types to a typeless language.

```
GET "libhdr"

LET start() BE
$( LET len = VEC 2
   writes("Enter three lengths: ")
   FOR i = 0 TO 2 DO len!i := readn()
   writes("*nTriangle entered: ")
   FOR i = 0 TO 2 DO writef("%n ", len!i)
   writef("*nThis is %s triangle*n",
            sort_of_triangle(len!0, len!1, len!2))
$)

AND sort_of_triangle(a, b, c) =
    b<a          -> sort_of_triangle(b, a, c),
    c<b          -> sort_of_triangle(a, c, b),
    // At this point we know that a <= b <= c
    c>a+b        -> "not a",
    a=c          -> "an equilateral",
    a=b | b=c    -> "an isosceles",
    c*c=a*a+b*b -> "a right angled",
                   "a scalene"
```

Figure 1 - The Triangle Problem

```
LET bits(w) = w=0 -> 0, 1 + bits(w & w-1)

LET gray(n) = n NEQV n>>1

LET dragon() BE FOR i = 0 TO 1023 DO
    SWITCHON bits(gray(i)) & 3 INTO
    $( CASE 0: right(); ENDCASE
            CASE 1: up();    ENDCASE
            CASE 2: left();  ENDCASE
            CASE 3: down();  ENDCASE
    $)
```

Figure 2 - The dragon program

Language Summary

Since most of BCPL is simple and unsurprising, only a brief summary of the language is required here. Its most obvious peculiarity is that all expressions yield word sized values, which can nowadays safely be assumed to be 32 bits long. The compiler takes no interest in the sorts of object (integer, character, truth value, bit pattern, vector, string, procedure etc) that such bit patterns represent. The user may thus have variables whose conceptual types vary dynamically during the execution of the program. Users of typed languages notice the loss of compile-time checking inherent in this scheme without realising the many advantages.

The syntax of BCPL is simple and can be regarded as a cut down dialect of C with no types, no structure declarations, fewer parentheses and almost no semicolons. The tokens $ (and $) correspond to { and } in C, and are used in declarations and commands. The operators = and := correspond to the C operators == and = (but in BCPL an assignment is not regarded as a kind of expression, and so does not yield a result).

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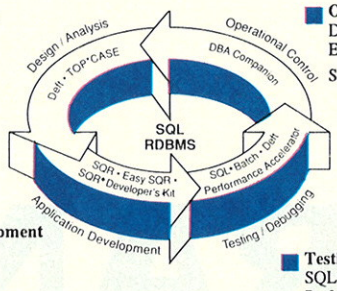

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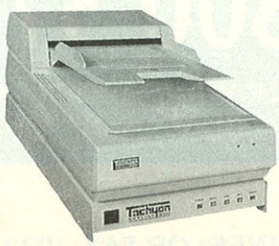

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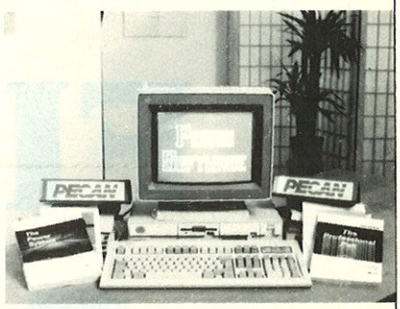

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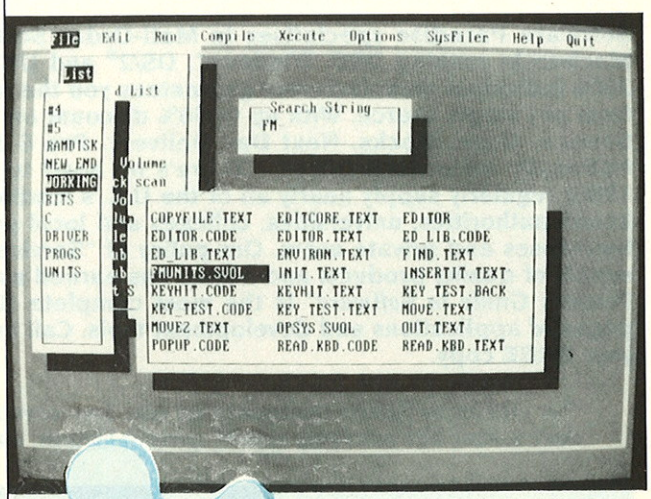

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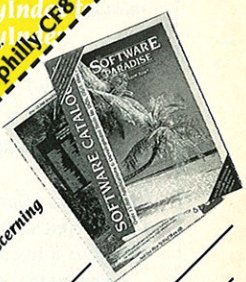

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w	0010 1101 1100 0101 0111 0000 0000 0000
w-1	0010 1101 1100 0101 0110 1111 1111 1111
w & w-1	0010 1101 1100 0101 0110 0000 0000 0000

Figure 3 - The effect of w & w-1

The expressions `@E` and `E1!E2` correspond to the C expressions `&E` and `E1[E2]`, and the expression `S%i` allows access to byte `i` of string `S`. There are the normal integer arithmetic operators: `*`, `/`, `REM`, `+`, `-` and `ABS`, and relational operators: `=`, `~=`, `<`, `<=`, `>` and `>=`. There are operators that work directly on bit patterns: `<<`, `>>`, `NOT`, `&`, `|`, `EQV` and `NEQV`. The conditional expression `E1->E2,E3` is equivalent to the C expression `E1?E2:E3`, and there is a `VALOF-RESULTIS` construct that allows commands and declarations to be embedded in expressions.

The keywords `IF`, `UNLESS`, `TEST`, `WHILE`, `UNTIL`, `REPEATWHILE`, `REPEATUNTIL`, `REPEAT` and `FOR` provide a rich collection of self-explanatory conditional commands, and these are augmented by the commands: `BREAK`, `ENDCASE`, `RESULTIS E` and `RETURN` which provide exits from various constructs, together with `LOOP` which is more or less equivalent to the C `continue` statement. This variety of exiting commands almost eliminates the need for `GOTO` commands. In the 4271 source lines of one version of the compiler, there are only nine `GOTO` commands (all in one routine concerned with error conditions) - none of which are actually executed when the compiler compiles itself. The BCPL `SWITCHON` command closely resembles the C `switch` statement.

The language makes a syntactic distinction between expressions and commands, and there is a similar distinction between *functions*, which yield results, and *routines*, which do not. Functions, routines, vectors and simple variables are declared using the following constructs:

```
LET N(N1,... Nn) = E
LET N(N1,... Nn) BE C
LET N = VEC K
LET N1,... Nn = E1,... En
```

The arguments to functions and routines are called by value, and do not have to agree in number with the parameters in the corresponding declaration. If too few are supplied, undefined values are added; if too many are given, the superfluous ones are thrown away. Technically speaking, BCPL functions are both variadic and (as far as the user is concerned) polymorphic. This is particularly useful for routines like `writef` (similar to `printf` in C) where the number and (conceptual) types of arguments depend on the format string. The n^{th} argument can be accessed either directly using its name, or by means of pointer arithmetic on the address of an earlier argument. This is possible since all values (and hence all arguments) are the same size.

BCPL has become one of the very few typeless languages that still exists

Following the convention of this magazine, my first example - shown in Figure 1 - is a solution to the 'Triangle Problem'.

To conform with the rules of the problem, the program declares a vector (`len`) with three elements (`len!0`, `len!1` and `len!2`) to hold the lengths of the three sides of the triangle. After prompting the user, it reads in three integers (using `readn`) by means of a rather unnecessary `FOR` loop. Notice that the control variable of the `FOR` command is treated as a declaration, and so `i` does not need to be previously declared. Within the `writef` format string, the substitution items `%n` causes the decimal value of the next argument to be output, and `%s` outputs the next argument as a string. The sequence `*n` in a BCPL string encodes the newline character (just as `\n` does in C). The function `sort_of_triangle` returns a string used in the message describing the kind of triangle. Notice how recursion is used to

n	*gray(n)*	*bits(gray(n))*	*direction*
0 = 000	000	0	right
1 = 001	001	1	up
2 = 010	011	2	left
3 = 011	010	1	up
4 = 100	110	2	left
5 = 101	111	3	down
6 = 110	101	2	left
7 = 111	100	1	up

Figure 4 - Computation of bits(gray(n))

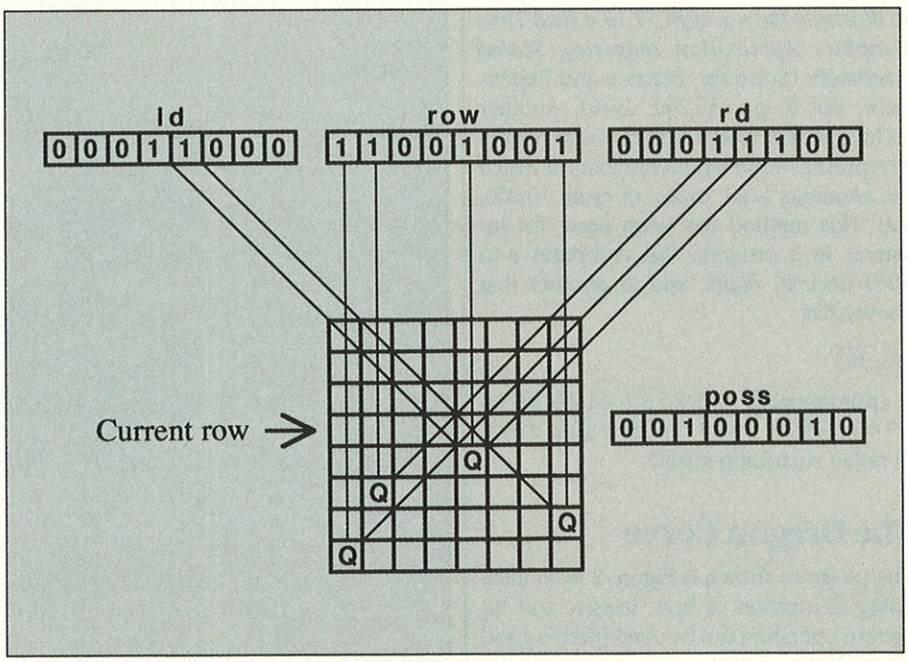

Figure 5 - The Dragon Curve

```
GET "libhdr"

STATIC $( count = 0  $)

LET try(ld, row, rd) BE TEST row=#xFF
THEN count := count + 1
ELSE $( LET poss = #xFF & NOT (ld | row | rd)
        UNTIL poss=0 DO $( LET p = poss & -poss
                           poss := poss - p
                           try(ld+p<<1, row+p, rd+p>>1)
                        $)
     $)

LET start() BE
$( try(0, 0, 0)
   writef("Number of solutions is %n*n", count)
$)
```

Figure 6 - The Eight Queens Program

sort the side lengths a, b and c into ascending order - to simplify the subsequent tests.

Although some BCPL systems provide single length floating point arithmetic, most people agree that mixing integer and floating point in a typeless language is inherently unsatisfactory. The triangle problem does not insist that the side lengths are to be floating and so I have chosen to use integers, and have thrown in, for good measure, a test for right angle triangles.

That BCPL does not provide floating point operations does not imply that it cannot deal with real numbers. One can, for instance, perform scaled arithmetic quite conveniently using the library function `muldiv`, which takes three arguments and yields the result of dividing the third into the double length product of the first two. An example of its use can be found in a simple flight simulator described in my paper *Jumbo - A Demonstration Program to Illustrate the use of BCPL in a Real Time Graphics Application requiring Scaled Arithmetic* (Software, Practice and Experience, Vol 9, pp.255-259, 1976). Another technique that works well is to use vectors to represent multi-length numbers in which the elements hold 'digits' of radix 10,000, say. This method has been used, for instance, in a program that computes *e* to 2000 decimal digits, and in another that shows that

$$e^{\pi\sqrt{163}}$$

is approximately: `26 2537 4126 4076 8743.9999 9999 9999 2500 7225` (a rather surprising result).

The Dragon Curve

The program shown is Figure 2 is an intriguing illustration of how integer and bit pattern operators can be combined to good effect. Notice that there is no need for the casts or type transfer functions, often required in typed languages, when mixing integer and bit pattern operations. The expression `w & w-1`, used in the definition of `bits`, removes the least significant `1` from the bit pattern `w`, as can be seen from the example shown in Figure 3.

Those looking for a real challenge might try recoding the algorithm in Pascal

The definition of bits uses this effect to count the number of ones in its argument, and is particularly efficient when the answer is small. Gray code is an encoding of integers in binary in such a way that consecutive integers differ in just one bit position, and the function `gray` converts its argument into the corresponding gray code (*Editor's note:* `NEQV` in `gray` works like an XOR operator). Figure 4 show the effect of the first eight steps of the `FOR` loop in `dragon`. With `up`, `down`, `left` and `right` suitably defined as graphics functions, this program generates the picture shown in Figure 5 which is, of course, the well known Dragon Curve.

Readers might like to compare this program with the one involving real arithmetic on $\sqrt{2}$ and $\pi/4$ written as a solution to problem 4-16 in the famous book *LISP* by Winston and Horn (pub Addison-Wesley, 1981).

The Eight Queens

The problem of counting how many ways eight queens can be placed on a chess board without any two occupying the same row, column or diagonal is another favourite that benefits considerably from mixed integer and bit pattern operations. A solution is given in Figure 6. It uses recursion to 'walk' over the tree of possible queen positions. The variable `poss` holds a bit pattern indicating where a queen can

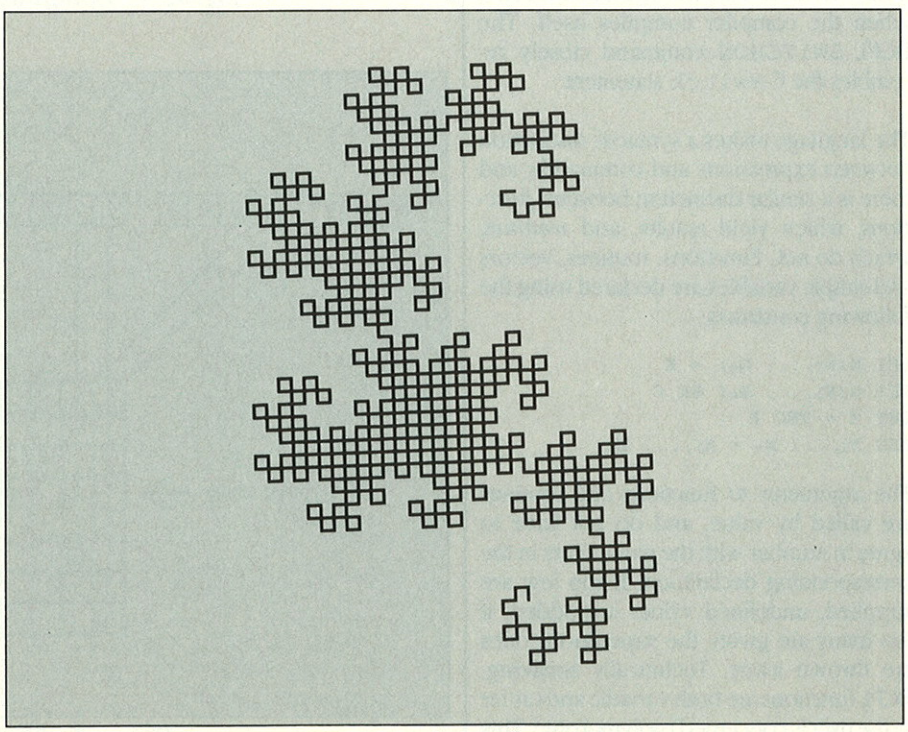

Figure 7 - The Eight Queens

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```
GET "libhdr"

MANIFEST $(
Op=0; Val=1; L=1; R=2 // The selectors
Numb=0; Mult=1; Div=2 // The operators
Plus=3; Minus=4
$)

GLOBAL $( ptr:200 $)

LET list(n, a, b, c) = VALOF
$( LET v = @a
   ptr := ptr - n
   FOR i = 0 TO n-1 DO ptr!i := v!i
   RESULTIS ptr
$)

AND randtree(n) =
   n=0 -> list(2, Numb, randno(1000)),
   VALOF $( LET lno = randno(n) - 1
            LET rno = n - lno - 1
            RESULTIS list(3, randno(4),
                             randtree(lno),
                             randtree(rno))
         $)

AND eval(x) =
   Op!x = Numb  -> Val!x,
   Op!x = Mult  -> eval(L!x) * eval(R!x),
   Op!x = Div   -> eval(L!x) / eval(R!x),
   Op!x = Plus  -> eval(L!x) + eval(R!x),
   Op!x = Minus -> eval(L!x) - eval(R!x),
   abort(999)

LET start() BE
$( LET v = VEC 1000
   ptr := v+1000
   writef("Value = %n*n", eval(randtree(7)))
$)
```

Figure 8 - A random expression evaluator

be placed in the current row, and the expression `poss & -poss` is used in a loop to pick each possible square in turn.

Figure 7 illustrates how `ld`, `row` and `rd` hold information about which column and diagonal positions are already occupied. Readers may care to compare this program with the treatment of the same problem given by Niklaus Wirth himself in a paper called *Program development by stepwise refinement* (Comm ACM, 14, pp 221-227, 1971), and those looking for a *real* challenge might try recoding the algorithm in Pascal.

Trees and Structures

The program shown in Figure 8 is to illustrate how structures are typically handled. It builds a tree representing a random expression composed of integers, in the range `1` to `1000`, and dyadic operators `*`, `/`, `+` and `-`. The call `randtree(n)` builds a tree containing exactly `n` operators, and `eval` attempts to evaluate the random expression. Notice that the function list is both variadic and polymorphic, since `y` is sometimes an integer and sometimes a pointer and `z` is not always supplied.

It is hardly possible in so short an article to give a proper feel of BCPL. However, a book is in preparation that includes many more example programs together with a detailed analysis of a machine independent implementation of BCPL. This version of the compiler will soon be available, for a small charge, to people with access to a C system.

.EXE

Martin Richards obtained his PhD at Cambridge in 1966. After two years at MIT, where he designed and implemented the first version of BCPL, he returned to Cambridge where he is now a Lecturer in Computer Science and Fellow of St John's College. He has a variety of interests, ranging from language and compiler design to hardware validation and theorem proving.

Dr Richards' forthcoming book is entitled BCPL - The Inside Story, *and should appear in 1992. We'll let you know when it does.*

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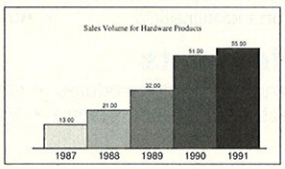

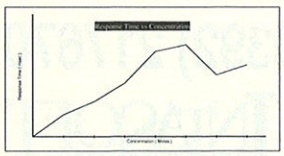

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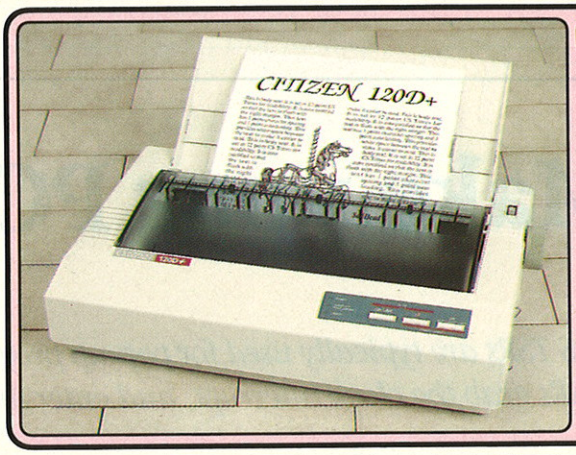

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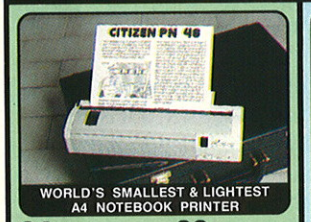

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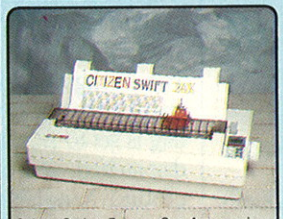

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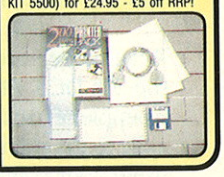

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Make your PC sweat

MS-DOS TSRs are typically used for pop-up programs and device drivers. Sean Sheehan's TSRs grab the clock interrupt, and enter the world of background processing...

I can have Sidekick and dozens of other programs lurking around in my computer, waiting for me to pop them up with a hot-key. Leaving aside the issue of whether we *need* all these pop-ups (which seem to me to be the height of laziness: why not just exit out of one program and then run another, instead of wasting the computer's memory... but this is *Code Page*, not *Soapbox*), there is a more down-to-earth application of TSRs, which can extend the capability of the humble PC to simple process control: background processing.

Example

This article looks at a very simple example, written in Microsoft C. Suppose you have written a wonderful program, which performs a whole range of clever things (or alternatively you are Ashton Tate and you have written dBASE IV, ho ho). You decide, as a finishing touch, that in the top right hand corner of the screen you display a digital clock, complete with flashing : dots to indicate that the seconds are ticking away. To do this, you require a set of C routines which will enable you to have background activity without interfering with the main program.

What models are there for this code? Well, the MS-DOS PRINT spooler is a classic example of background activity: it can print a file to the printer while you can continue using your computer. This is achieved by capturing a special interrupt known as the *MS-DOS idle*. Whenever MS-DOS is waiting for the user to press a key (about 99% of the time) it is idle, and whenever MS-DOS is idle it generates an interrupt. Capture this interrupt and your handler can perform virtually anything (except use DOS calls to write to the screen or read from the keyboard).

```
enum taskstatus
{ SLEEP, RQRUN, ACTIVE };

struct CLOCKEDSUB
{
  void (*function)(void);
  int CurrentTime;
  int DelayTime;
  enum taskstatus BusyFlag;
};
```

Figure 1 - CLOCKEDSUB structure

If a function that is to be run as a background routine takes too long, the computer response time will decrease

The main disadvantage with this approach is that only one background routine can be active. A better design would allow us an unlimited-ish amount of background activity available to various tasks, each with its own running frequency. This is achieved by turning the idle interrupt handler into a background function dispatcher, and capturing the clock tick interrupt (which strikes 18.2 times a second). To commence background activity we specify a function name and time interval.

The dispatcher

To enable the clock tick handler to set up a function for dispatching, I formulated a structure `CLOCKEDSUB` (Figure 1) which holds a pointer to the function that will be dispatched, a count of number of ticks expired since the last run, the number of ticks to wait before dispatching the function and a busy flag.In order to allow several functions to be dispatched an array of `CLOCKEDSUB` structures is used.

The clock tick handler updates the number of ticks expired and compares them with dispatch time. If they match and the busy flag is `SLEEP` (the routine is not running), the busy flag is set to request a run (`RQRUN`). The handler then returns control back to the main program.

The background dispatcher handler then checks if the busy flag is `RQRUN`. If it is, the flag is set to `ACTIVE`, the function is then dispatched, and on returning to the background handler the busy flag is set to `SLEEP` again, ready for the next time.

Microsoft C has several functions which are designed to get and set MS-DOS interrupt vectors, these functions are used to install the clock tick handler and background dispatcher handler (Figure 2). Before your program exits back to DOS, it is important to restore the addresses of the original interrupt handlers in the interrupt vector table. You should also only install the interrupt routines once, and only remove them if they have already been installed. Beware - this is not checked in my code. You might consider adding a suitable test.

```
_disable();
oldint1c=_dos_getvect(INT1C);
oldint28=_dos_getvect(INT28);
_dos_setvect(INT1C,ClockHandler);
_dos_setvect(INT28,BackgroundHandler);
_enable();
```

Figure 2 - Capturing interrupts

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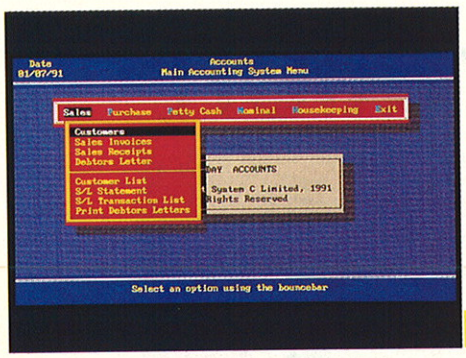

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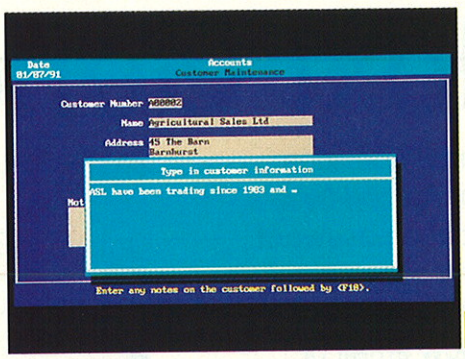

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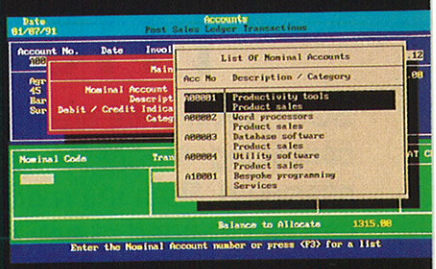

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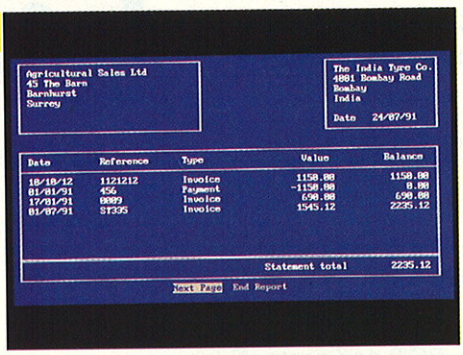

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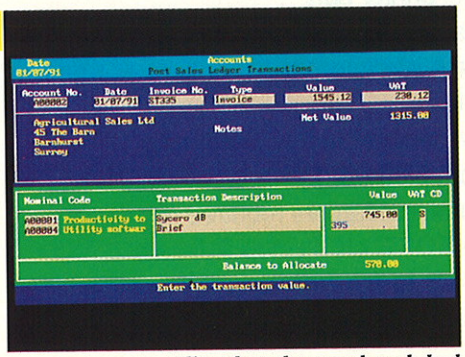

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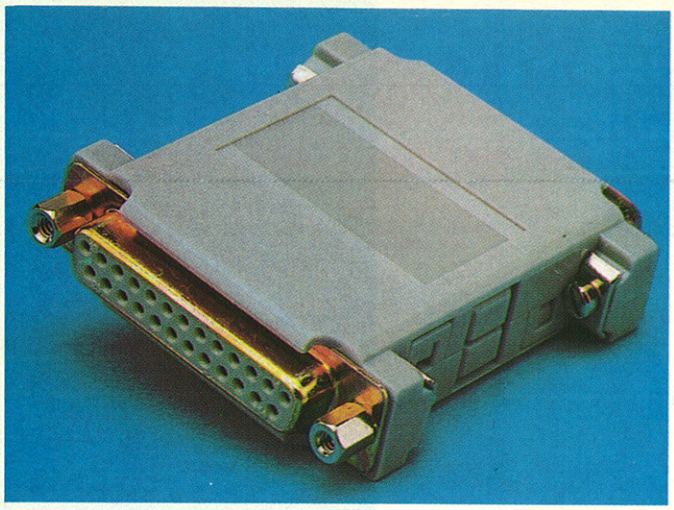

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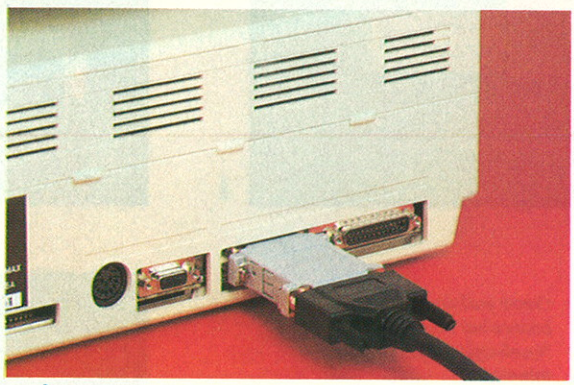

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Putting it together

Four functions (`SetupClockedSubs()`, `ClockedSub()`, `ClockHandler()` and `BackgroundHandler()`) produce background processing within C. `SetupClockedSubs()` can perform one of four options depending on the parameter you specify. `INSTALL` captures the clock tick and idle interrupts, replacing the interrupt vector with the address of the interrupt handlers, `REMOVE` restores the original interrupt handlers, `ON` turns background processing on and `OFF` stops it.

`ClockedSub()` adds an entry to the `CLOCKEDSUB` array and increments a count of defined clockedsubs. (NB - As the code stands, once an entry has been defined in the array there is no way of removing it.) `ClockedSub()`'s parameters are the address of a function (whose parameter and return value is `void`), and a time interval (in clock ticks). Remember: if a function that's running in the background takes too long to return control, the computers response time will decrease.

In general, an interrupt routine cannot make any calls to MS-DOS (interrupt 21h), and cannot use C functions that are not reëntrant (which does not leave very many). Clockedsub functions, however, can make calls to DOS (since DOS is idle when background routines run), except those calls that write to the screen or read from the keyboard. To provide these facilities you must produce your own screen and keyboard handling based on BIOS calls or direct manipulation.

Once you have read through the code in the example application (Figure 3) it should not be too difficult for you to modify it to produce hotkey activated functions or mouse press activated functions. Or turn your PC into a real-time process control system...

EXE

Sean Sheehan has been a software engineer for two years investigating possible process control systems on an IBM PC AT using Microsoft C 5.1 and MASM 5.1 . Prior to this he was studying at Liverpool Polytechnic where he gained an HND in computer studies.

Special thanks to Brian Carter for his Read-Time function.

```
/* Program displays a real time clock
   using background processing.
*/

#include <stdio.h>
#include <dos.h>
#include <graph.h>
#include <stdlib.h>
#pragma check_stack(off)

/* define special symbols */

#define INSTALL 0
#define REMOVE  1
#define ON      2
#define OFF     3

/* Clock tick interrupt */
#define INT1C   0x1c
/* Idle interrupt */
#define INT28   0x28
/* Vector number for real time clock */
#define INT1A   0x1a
/* maximum no of clocked subroutines */
#define MAX     20

/* REGLIST is used as the parameter
   list for an interrupt routine      */

#define  REGLIST \
  unsigned es, unsigned ds, unsigned di,\
  unsigned si, unsigned bp, unsigned sp,\
  unsigned bx, unsigned dx, unsigned cx,\
  unsigned ax, unsigned ip, unsigned cs,\
  unsigned flags

/* Function prototypes */

void interrupt far ClockHandler (REGLIST);
void interrupt far
            BackgroundHandler (REGLIST);
void (interrupt far *oldint1c)(void);
void (interrupt far *oldint28)(void);
void ClockedSub
        (void (*pointer)(void),int time);
void SetupClockedSubs (int action);
void ReadTime (void);
void dots (void);
void DrawClock (void);

char time_buff[20];
char *time_pnt;
int toggle =0;
void settextcolour (long colour );
void setbkcolour (long colour);
void outtext (char *ptr);
void settextposition (int row, int col);
struct rccoord gettextposition (void);

/* BIOS defs and variables */

#define INT10  0x10
union REGS regs;
int FGColour=7,BGColour=0;

/* Stucture, variable definitions */

enum taskstatus {SLEEP,RQRUN,ACTIVE};
enum taskstatus busyflag;
```

```
struct CLOCKEDSUB
{
   void  (*function)(void);
   int   CurrentTime;
   int   DelayTime;
   enum  taskstatus  BusyFlag;
};

/* array of CLOCKEDSUB's */
struct CLOCKEDSUB clocklist [MAX];

/* Count of current Clocked subs  */
int ClockCount=0;


/* main program */

main ()
{
  _clearscreen(_GCLEARSCREEN);
  /* Install Backgound stuff */
  SetupClockedSubs (INSTALL);
  ClockedSub (ReadTime,18);
  ClockedSub (dots,9);
  ClockedSub (DrawClock,18);

  SetupClockedSubs (ON);

  _settextposition(0,0);
  _outtext("Demonstrate CLOCKEDSUB");
  _settextposition(10,0);
  _outtext("Hit any key - ESC to end");
  _settextposition(11,0);
  /* Wait for ESC */
  while (getche()!=27);

  /* Kill + remove background activity */
  SetupClockedSubs (OFF);
  SetupClockedSubs (REMOVE);
  return 0;
}


void SetupClockedSubs (int action)
{
  switch (action)
  {
    case  INSTALL:
      _disable();
      oldint1c=_dos_getvect(INT1C);
      oldint28=_dos_getvect(INT28);
      _dos_setvect(INT1C,ClockHandler);
      _dos_setvect
    (INT28,BackgroundHandler);
      _enable();
      break;
    case  REMOVE:
      _disable();
      _dos_setvect(INT1C,oldint1c);
      _dos_setvect(INT28,oldint28);
      _enable();
      break;
    case  ON:
      busyflag = ACTIVE;
      break;
    case  OFF:
      busyflag = SLEEP;
      break;
  }
}
```

```
void ClockedSub
        ( void (*pointer)(void),int time)
{
  clocklist[ClockCount].function=pointer;
  clocklist[ClockCount].CurrentTime=0;
  clocklist[ClockCount].DelayTime=time;
  clocklist[ClockCount].BusyFlag=SLEEP;
  ClockCount++;
}

void interrupt far ClockHandler (REGLIST)
{
  static int localcount=0;
  static struct CLOCKEDSUB *curtask;
  if (busyflag==ACTIVE)
  {
    localcount=0;
    while (localcount < ClockCount)
    {
      curtask = clocklist + localcount;
      curtask->CurrentTime++;
      if (curtask->CurrentTime >
                  curtask->DelayTime)
      {
        if (curtask->BusyFlag == SLEEP)
        {
          curtask->CurrentTime=0;
          curtask->BusyFlag=RQRUN;
        }
      }
      localcount++;
    }
  }
  _chain_intr(oldint1c);
}

void interrupt far BackgroundHandler
                  (REGLIST)
{
  static int localcount=0;
  static struct CLOCKEDSUB *curtask;
  if (busyflag==ACTIVE);
  {
    localcount=0;
    while (localcount < ClockCount)
    {
      curtask = clocklist + localcount;
      if (curtask->BusyFlag==RQRUN)
      {
        curtask->BusyFlag=ACTIVE;
        (*curtask->function)();
        curtask->BusyFlag=SLEEP;
      }
      localcount++;
    }
  }
  _chain_intr(oldint28);
}


/* Background functions to be dispatched */

void ReadTime (void)
{
  int i;
  int hours, mins, day, month, year;

  regs.h.ah = 0x2;
  int86(INT1A, &regs, &regs);
```

Figure 3 - Example program using Clocked subroutines (Continued overleaf)

```
  hours = 10 * ((regs.h.ch & 0xf0)/16)
          + (regs.h.ch & 0x0f);
  mins  =  10 * ((regs.h.cl & 0xf0)/16)
          + (regs.h.cl & 0x0f);
  regs.h.ah = 0x4;
  int86(INT1A, &regs, &regs);
  day   = 10 * ((regs.h.dl & 0xf0)/16)
          + (regs.h.dl & 0x0f);;
  month  = 10 * ((regs.h.dh & 0xf0)/16)
          + (regs.h.dh & 0x0f);
  year  = 10 * ((regs.h.cl & 0xf0)/16)
          + (regs.h.cl & 0x0f);
  /* fill the time/date ascii buffer */
  time_pnt = time_buff;
  for (i=0;i<20;i++,time_pnt++)
    *time_pnt = ' ';
  time_pnt = time_buff;
  if (hours<10)  time_pnt++;
  itoa(hours,time_pnt,10);
  if (hours<10)  time_pnt++;
  else           time_pnt=time_pnt+2;
  *time_pnt = ':';
  time_pnt++;
  if (mins<10)
  {
    *time_pnt = '0';
    time_pnt++;
    itoa(mins,time_pnt,10);
  }
  else
    itoa(mins,time_pnt,10);
  time_pnt = time_pnt + 3;
  itoa(day,time_pnt,10);
  if (day<10) time_pnt++;
  else        time_pnt=time_pnt+2;
  *time_pnt = '-';
  time_pnt++;
  itoa(month,time_pnt,10);
  if (month<10)  time_pnt++;
  else           time_pnt=time_pnt+2;
  *time_pnt = '-';
  time_pnt++;
  itoa(year,time_pnt,10);
}

void dots (void)
{
  static struct rccoord rc;

  rc=gettextposition();
  settextposition(1,70);
  if (toggle)
     outtext(":");
  else
     outtext(" ");
  toggle= !toggle;
  settextposition(rc.row,rc.col);
}

void DrawClock (void)
{
  static struct rccoord rc;
  static char clkbuff[4];
  static char *ptr;

  clkbuff[2]=0;
  rc=gettextposition();
  settextposition(1,68);
  ptr=time_buff;
  clkbuff[0]=*ptr++;
  clkbuff[1]=*ptr++;
  outtext(clkbuff);
  settextposition(1,71);
  ptr++;
  clkbuff[0]=*ptr++;
  clkbuff[1]=*ptr++;
  outtext(clkbuff);
  settextposition(rc.row,rc.col);
}

/* Special routines to write to the screen
   from within a clocked subroutine
*/


void settextcolour (long colour )
{
  FGColour = colour;
}

void setbkcolour (long colour)
{
  BGColour = colour;
}

void outtext (char *ptr)
{
  static struct rccoord rc;

  rc = gettextposition();
  while (*ptr != NULL)
  {
    regs.h.ah=0x09;
    regs.h.al=*ptr;
    regs.h.bh=0x00;
    regs.h.bl=(BGColour*16)+FGColour;
    regs.x.cx=1;
    int86(INT10,&regs,&regs);
    ptr++;
    rc.col++;
    settextposition(rc.row,rc.col);
  }
}

void settextposition (int row, int col)
{
  regs.h.ah = 0x02;
  regs.h.bh = 0x00;
  regs.h.dh = row;
  regs.h.dl = col;
  int86(INT10,&regs,&regs);
}

struct rccoord gettextposition (void)
{
  static struct rccoord rc;

  regs.h.ah = 0x03;
  regs.h.bh = 0x00;
  int86(INT10,&regs,&regs);
  rc.row = regs.h.dh;
  rc.col = regs.h.dl;

  return rc;
}
```

Figure 3 - Example program using Clocked subroutines (Continued)

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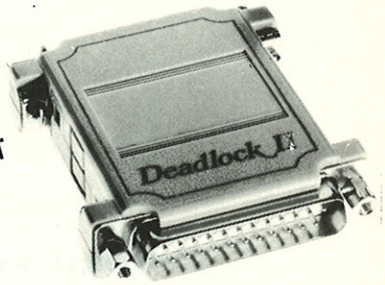

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Find

The syntax of the UNIX command find frightens off many potential users. Peter Collinson explains the advantages of not being a scaredy-cat.

When you attempt to teach some of the arcane mysteries of UNIX to some unsuspecting class, you always emphasise the regular structure of the command syntax. The command line consists of a command name, some program options and possibly some filenames. The options always start with a hyphen, and consist of single letters. Many commands follow this format, many do not. This *is* UNIX after all. A prime example that contravenes this general set of rules is the `find` command.

It seems that people are *proud* to be ignorant of the `find` command. I often hear 'I have never managed to get to grips with `find`'. It is said in the same pleased tone that people say 'I just can't do maths'. Yet the `find` command is one of the most useful tools that UNIX supplies. It can save hours of searching for files. It can be used in scripts to create other tools that save you time. I used to miss it dreadfully on DOS, I now use the version from the MKS toolkit.

Basic operation

The `find` command performs a recursive decent of the tree structure that comprises the file system. It looks at every file that it encounters and applies a set of user selected tests to them. Remember that directories are files. The simplest useful command is:

```
find . -print
```

This runs `find` in the current directory, 'dot', and prints the relative pathnames of all the files that it finds. It will look in the named directory and any directories under that. Here is the command being run in the `/usr/spool` directory of my machine:

```
.
./mqueue
./mail
./mail/root
./lw
./lw/.seq
./lw/lock
./lw/options
./lw/lw-log
./lw/.status
./lw/status
./lw/.railmag
./lpd.lock
./cron
./cron/crontabs
./cron/crontabs/root
./cron/atjobs
./cron/.proto
etc etc
```

The output is printed in the order that the command finds the names in the directory. It is not sorted. Notice that it prints both a subdirectory name `./lw`, and its contents `./lw/*`.

I would guess that the simple command is rarely used. It is more usual to see two or more options being given to `find`. For example, if we are looking for a particular file we would say:

```
find . -name fred -print
```

This reads as: start in the current directory and look for a file called `fred` in that and any subdirectories. If one is found, print its relative pathname. Many options to `find` are like `-name` and take an argument, in this case the string `fred`.

The key aspect of understanding what is happening is the tiny word *and*. We think of the options as a set of tests (or actions) that obey the laws of boolean algebra. We can string tests together with the *and* operator, `-a`:

```
find / test1 \
     -a test2 \
     -a test3
```

(The line is split here for printing reasons - I have added a backslash to show that a line is supposed to be joined to the next. I will use this convention below.) The whole expression will be true if and only if *test1*, *test2* and *test3* are all true. We also know that if *test1* is false then the other tests will not be performed. Similarly we won't execute *test3* if *test2* fails.

Tests are most often connected by *and* operators, and typing can be saved by omitting the explicit `-a`. To execute a set of tests on all the files underneath the `start` directory we can write:

```
find start test1 \
           test2 \
           test3
```

How does this test idea fit in with the `-print` operator? It doesn't look much like a test. Action operators like `-print` return some defined truth value. They behave like constants; `-print` always returns True.

Looking for names

It is much more useful to be able to look for a range of filenames, rather than just one. You can supply the usual shell filename expansion characters to the argument of the `-name` test. So

```
find /usr -name  ',*' -print
```

starts at `/usr` looking for files that start with a comma. The syntax here is common to shells, the filename is specified as a comma followed by the metacharacter '*'. The star matches any sequence of characters.

Notice that the name argument is escaped with single quotes. If this seems a little fussy, then just stop a moment, look up and think why that should be necessary. Hopefully, you realised that if the argument was not escaped it would be expanded by the current shell before the `find` command is executed. We don't want this, we need to make sure that the syntax is passed *into* the `find` command rather than being interpreted by the shell - hence the quotes.

File names that start with a comma are often used as temporary file names. A one line script that can be used to delete all the comma files in the current subtree is then:

```
rm `find . -name ',*' -print`
```

This runs the `find` command to generate a list of suitable filenames. The backquote operator takes the list of files output from

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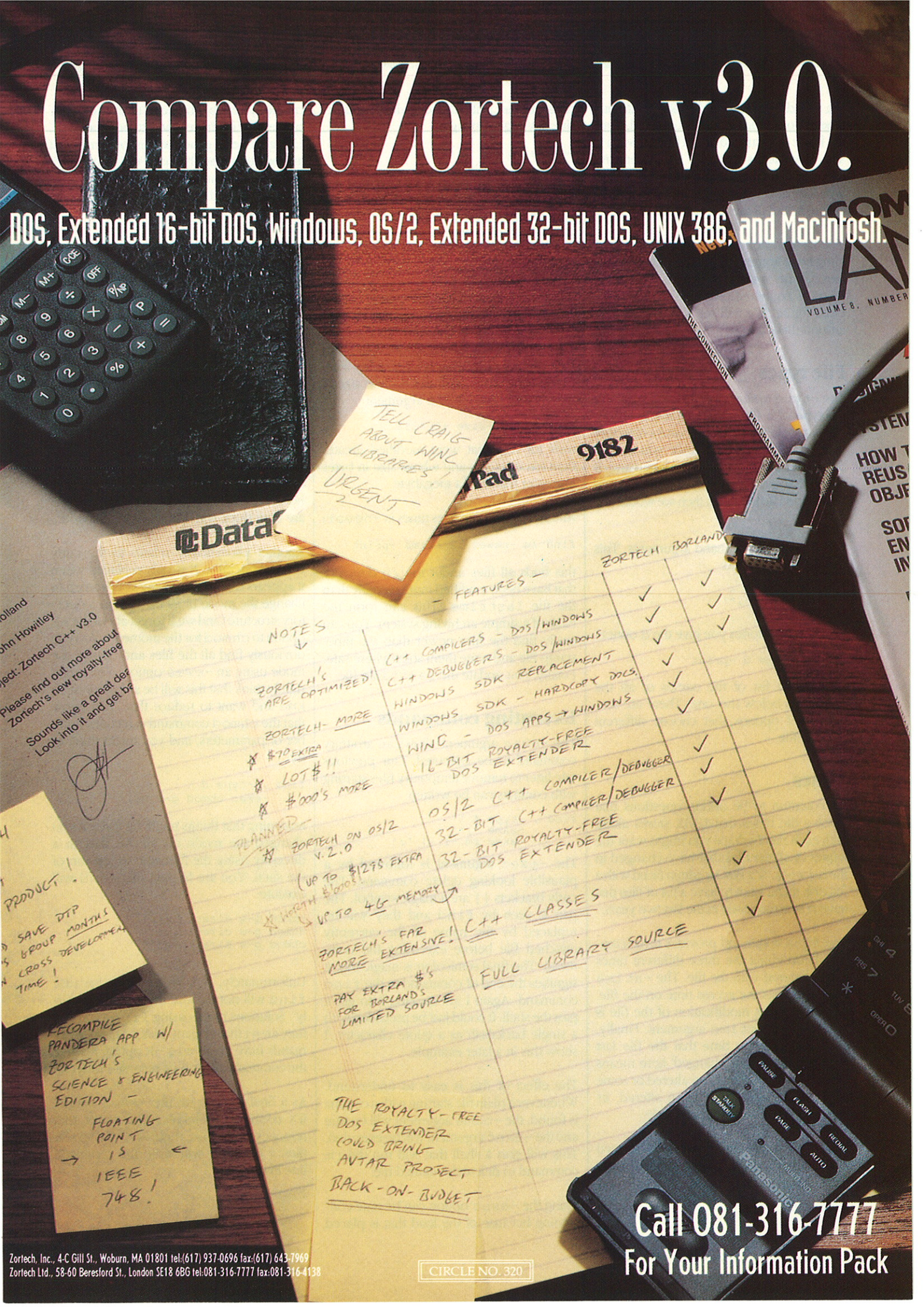

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the find command and makes it into parameters to be deleted by rm command. If you are brave you can add a -f (force) switch to rm. Faint-hearts can add -i (interactive delete option) to ensure that rm will prompt with the name of each file. This allows interactive control of the deletion process.

You have to be a little careful when generating huge argument lists as in the example here, some systems will limit the size in bytes of argument lists to 10 KB or some other figure. We will see a way of getting around this later on.

File types

The -type option allows you to select for the type of a file. In the example above, things would break if you found a directory starting with a comma since you cannot delete a directory with the rm command. If we wanted specify that only plain files should be included in the search then we would add

```
-type f
```

into the find command arguments. This makes the command:

```
find . -type f \
       -name ',*' \
       -print
```

To select directories you give the d option:

```
find . -type d -print
```

generates a list of the names of all the directories below this one. There are several other options that choose different types of file.

Times

It's common to be asking questions that involve the times that UNIX stores along with each file. Perhaps you might want the names of all the files that have changed in the last week, or a system admin faced with a full disk might want to have a list of files that haven't been accessed in the last two years.

The find command provides three commands matching the three different times that are stored with the file. The -atime argument tests the access time on the file. The time of last modification of the file is tested by the -mtime argument. Finally, -ctime tests the time that the file last changed. The word 'changed' here means that either the file has been altered or some attribute of the file has been altered, its permissions or owner for example.

Each of these three arguments are followed by a number giving the number of days that have elapsed:

```
-mtime 5
```

tests whether a file has been altered exactly five days ago. Saying

```
-mtime -5
```

tests whether a file has been altered in the *last* five days. You should read the minus sign as 'less than five days'. You might guess that a plus sign prefix means 'greater than'. You can obviously combine these:

```
-mtime -10 -mtime +1
```

will pick all the files that have altered in the last 10 days and have changed more than one day ago. This plus/minus idea can applied to other arguments whose values can be numeric, and we might reasonably want to test for a range. You can test the size of the file using the -size argument:

```
-mtime +10 -size +524288
```

tests for files that were modified greater than ten days ago and whose size in bytes is greater than half a megabyte.

Another option that uses times is -newer:

```
find /u -newer lasttime -print
```

this finds all files under the /u directory that have been modified more recently than the file lasttime. This can form the basis of a simple archiving system. You can easily find the files newer than the timestamp file and write them somewhere safe. Finally, you update the lasttime file.

Executing commands

The -exec argument allows an arbitrary command to be executed. Our previous one liner to remove temporary files starting with commas can be written:

```
find . -type f \
       -name ',*' \
       -exec rm -f {} ';'
```

The -exec argument is followed by a plausible looking delete command. The curly brackets { } are a magic symbol. The pair is seen by find and they will be replaced by the name of the currently matched file before executing the command. The final semicolon is magic too, it signifies the end of command to the find command. Again I am quoting it to get it past the shell. It could just be preceded with a single backslash as a quote character. I show this in a later example.

The effect of this is easy to understand. Whenever a plain file starting with a comma is found, the -name argument will be true and the -exec argument will be executed. This will start a shell that will run the rm command to delete the named file.

Using the -exec option can be time consuming because of the load that is placed on the system by the need to create a new process for each file that is to be processed. Using find to generate a list of names that are passed using the back-quote operator will often be much faster, but will also occasionally fail owing to argument list size restrictions.

I have always felt that there are some inconsistencies in the way that the argument to the -exec parameter is specified. It would make more sense to pass the command to be executed as a single argument, something like:

```
-exec 'rm -f {}'
```

The terminating semicolon would then not be needed since the argument is self contained in a string. This would be a good thing because then the -exec option could take embedded semicolons allowing it to perform more than one command. Unfortunately, this method of doing things was not selected by the original author and we are now stuck with the current behaviour.

Another idiosyncrasy relates to the curly bracket operator. It is only replaced when it appears by itself. Let's say you wanted to change the mode of all the files in a directory structure (and we'll forget about the -R option to chmod for the moment). You can obviously find all the files and change the mode using an -exec option. You might rightly think that this will be a heavy system load and want to reduce that. You know that the chmod command can take a number of parameters, and you might think to try:

```
find . -type d \
     -exec chmod g-w '{}/*' \;
```

reasoning that things might be faster if you changed the mode on all the files in a directory using the filename expansion of the shell. You are hoping that find will execute:

```
chmod g-w directory1/*
chmod g-w directory2/*
chmod g-w directory3/*
..
```

Unfortunately, this won't work because find will not expand the { } / * 'properly'. Solutions to this using find exist, but they aren't that elegant. Instead many commands have acquired a -R option making the command do its own recursive descent.

As a final thought on the -exec option, it's common to have some script that removes junk files regularly, say core files. I generally will write the command line like:

```
find / -name core \
       -mtime +1 \
       -exec rm -f {} \;
```

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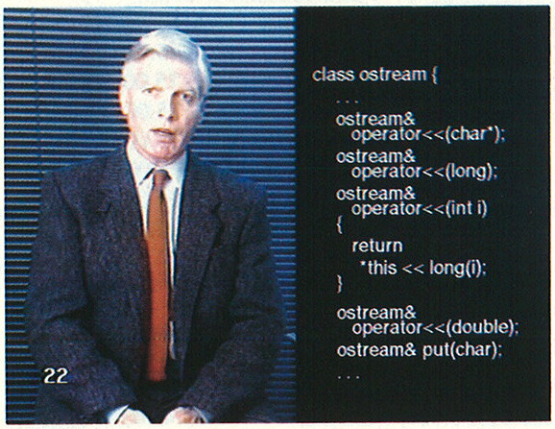

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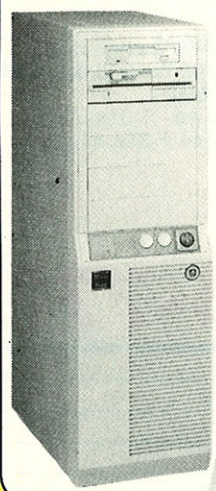

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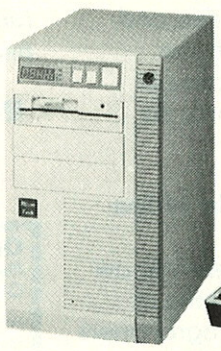

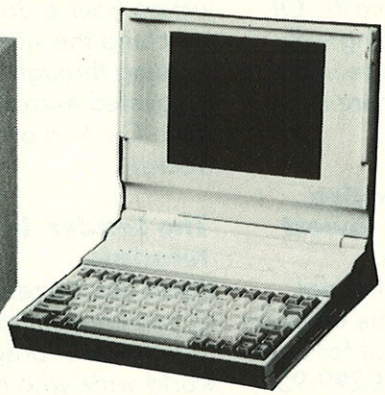

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This looks for files called `core` that have been modified greater than one day ago. If it finds any, then the `-exec` command is called to delete the file. The reason for `-mtime` argument is to improve the chances of a user who wants to use the file while the background delete script is being run. It's often the case that the deletion script gets run at night and it's annoying for the late night worker to find that the `core` file that they carefully created some minutes ago at 11.58pm has just been deleted by the helpful script. Adding the `-mtime` option leaves the file lying around for an extra day, but this won't hurt too much.

Grouping options

As we have seen the arguments to `find` are most often linked with an assumed *and* operator. However, it is common to want to say test for one thing *or* another. If we wanted to remove more than just `core` files in the example above, we might say:

```
find / -type f \
       '(' \
           -name core -o \
           -name ',*' \
       ')' \
       -mtime +1 \
       -exec rm -f {} \;
```

Again this should be one line. I have laid it out so that you can see the structure. It finds plain files who are called `core` *or* whose name starts with a comma. If the files have not been modified for a day then they are deleted. Notice the use of the round brackets to override precedence. These brackets mean something to most shells and must be quoted to get them into the `find` command.

The Find command performs a Recursive Descent of the tree structure that comprises the file system

You can supply a logical `not` operator by using the exclamation mark, this fragment

```
-name ',*' -a '!' -name ,keep
```

finds all the files under the current directory that start with a comma and are *not* called `,keep`. Notice that the exclamation point means something to shells and must be quoted. The symbol is used in `csh` to provide a history expansion and can only be quoted by preceding it with a backslash.

Scratching the surface

Well, if you got here I hope that you will no longer proudly exclaim that you can't use `find`. I have only scratched the surface and shown you the minimum set of options, you should consult your manual page to see the full set.

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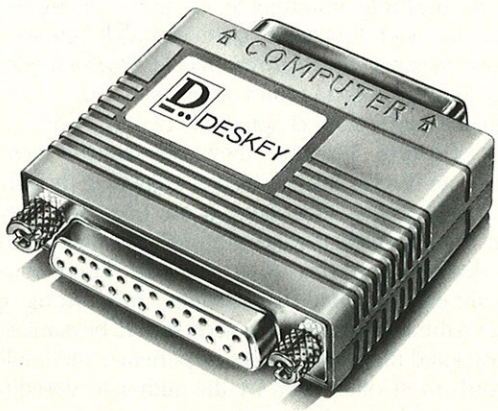
Peter Collinson is a freelance consultant specialising in UNIX. He can be reached electronically as `pc@hillside.co.uk` (although your mailer might be happier to put the address the other way round) or by phone on 0227 761824.



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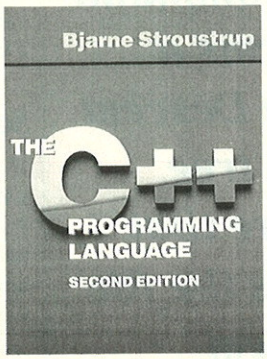
Bjarne's latest tome plus DOS 5 memory matters.

C++ - The New Testament



A lot has happened to C++ since Bjarne Stroustrup's seminal first edition of *The C++ Programming Language*. In the last six years it is estimated that the worldwide C++ user community has grown 100-fold. That in itself is a remarkable achievement and, in my opinion, endorses Stroustrup's approach to the development of the language. Those that have criticised C++ for not being a 'pure' object-oriented language, and for not redressing some of the problems inherent in C, must surely recognise that its success has been due, to a large extent, to the fact that it has maintained compatibility with C; at the source level and in terms of run-time efficiency. The increasingly general acceptance of C++ as 'a better C' means that the author's vision of the language is fast becoming a reality. Because of this, the key issues of the object-oriented revolution have shifted from what programming languages to use, to what are the most appropriate design and analysis methodologies one should employ. Although the second edition of Stroustrup's book remains the definitive work on the C++ language, careful consideration is also given to the broader aspects of object-oriented development.

At 669 pages, *The C++ Programming Language - second edition* is over twice as long as its predecessor, first published in 1986. Most of the extra text can be accounted for by the inclusion of an additional five chapters, covering the following topics - Templates; Exception handling; Design and development; Design and C++; and Design of libraries. Aside from the discussions of object-oriented design issues, a number of significant changes to the language are also documented. In Stroustrup's words, 'the overall theme of the extensions and revisions was to make C++ a better language for writing and using libraries'. The nature of these modifications has been influenced by both general experience with C++ and by ideas imported from other languages.

The template concept allows container classes (lists, arrays tables etc) to be simply defined and implemented without loss static type-checking or run-time efficiency. A kind of sophisticated macro facility, templates allow the programmer to define class-specific containers easily, without having laboriously to subclass a generic container for every type of object it may be capable of handling. A class template specifies how individual classes can be constructed much as a class declaration specifies how individual objects can be constructed. For example, if a container of type `stack` has been defined as a template, one can then declare class-specific `stacks` as follows:

```
\\ stack of pointers to shapes...
stack<shape *> ssp( 200 );
\\ stack of Points...
stack<Point> sp( 400 );
```

The `stack` template ensures that the methods of these class-specific `stacks` (eg `push()` and `pop()`) return values and take arguments of the correct type, thus maintaining rigorous type-checking. This welcome extension, partly inspired by Ada generics and partly by Clu's parameterised modules, should take the pain out of using containers and greatly increase their general usage.

The C++ exception handling mechanism (described in *.EXE* October '91) borrows ideas from Ada, Clu and ML. It is based on an expression that throws an exception to be caught by a handler. This facility has resulted in the addition of three new keywords to the language: `try`, `throw` and `catch`. It is mainly designed to improve the robustness of applications that make use of third party class libraries, by allowing the programmer to have greater control over what happens when something goes wrong. Since exceptions have only recently been accepted by the ANSI C++ standards committee (X3J16 - convened in December 1989), implementations are not yet widely available. The other major C++ extensions (such as multiple inheritance, `static` member functions, `const` member functions, pure virtual functions and `protected` members) have grown out of C++ user feedback and are already implemented in most compilers.

As mentioned above, chapters 11, 12 and 13 deal with various aspects of design. Together, they represent the most significant extension to the book since its first edition. Although Stroustrup emphatically asserts that there is no 'one right way', he does present several practical rules of thumb that should be considered when designing systems using C++. The discussions of design issues are extensive and enlightening. Quite strong opinions are voiced on the subject of how projects should be managed, and staff organised and motivated. 'Taste, experience and intelligence' are the words most often used by the author to describe how one writes good software. Stroustrup comes out firmly against a sharp distinction between designers and programmers, and places a premium on individuals with strong skills in both these areas.

Although Stroustrup has placed a greater emphasis on tutorial aspects than in the first edition, the book is still aimed at experienced programmers, and, quite rightly, is of very detailed and technical nature. If you're at all interested or involved in C++, this book is, in a word, essential.

Title: The C++ Programming Language - second edition *Pages: 669*
Author: Bjarne Stroustrup *Publisher: Addison Wesley*
Price: £23.95 *ISBN: 0-201-53992-6*

Books Received This Month

The X Windows System. A User's Guide by Niall Mansfield	Addison Wesley	£21.95	ISBN:0-201-563-444	pp344
Objective C - Object Oriented Programming Techniques by Lewis Pinson and Richard Weiner	Addison Wesley	£26.95	ISBN:0-201-508-281	pp313
The Standard C library by P J Planger	Prentice Hall	£29.95	ISBN:0-13-131509-9	pp498

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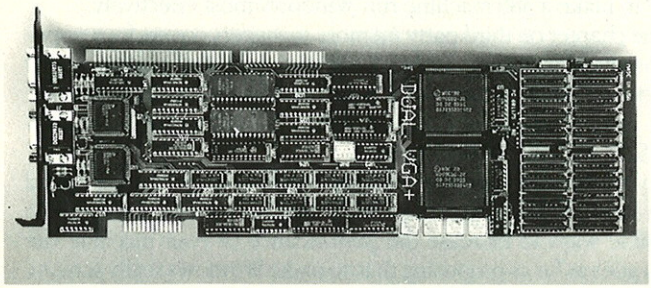

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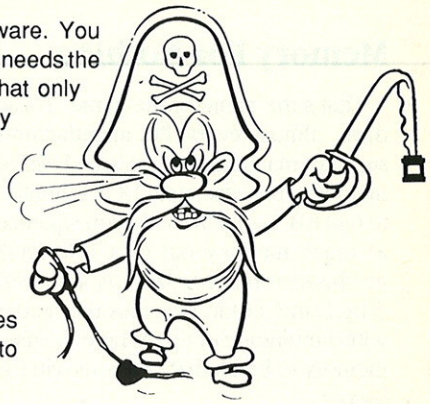

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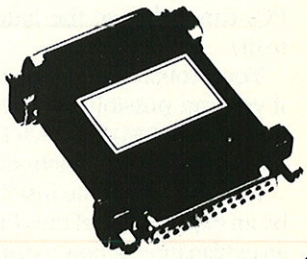

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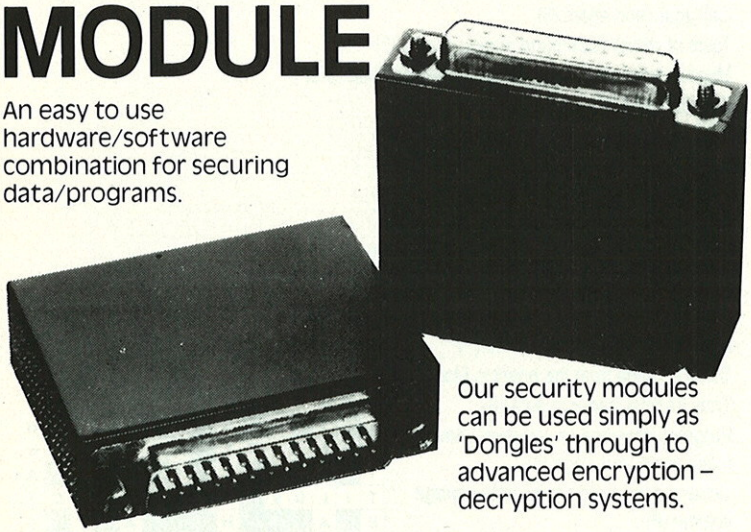

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CIRCLE NO. 325

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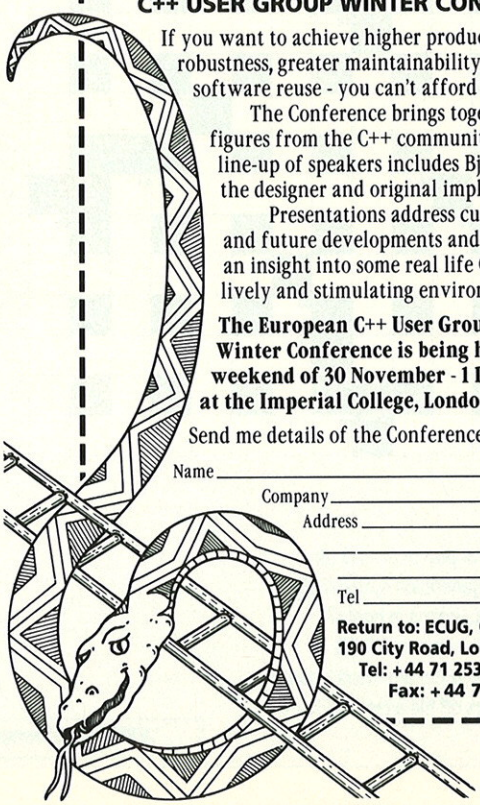

If you want to achieve higher productivity, greater robustness, greater maintainability and much higher software reuse - you can't afford to miss it.

The Conference brings together leading figures from the C++ community. An impressive line-up of speakers includes Bjarne Stroustrup, the designer and original implementor of C++.

Presentations address current concerns and future developments and will also provide an insight into some real life C++ projects in a lively and stimulating environment.

The European C++ User Group Winter Conference is being held over the weekend of 30 November - 1 December 1991 at the Imperial College, London.

Send me details of the Conference Programme now!

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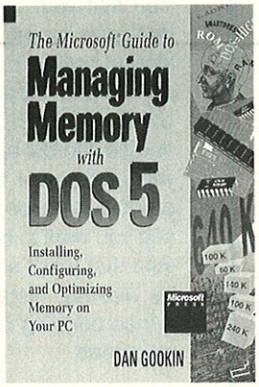
CIRCLE NO. 327

Memory For Nothing



That's the name of the game. These days, almost every PC manufacturer supplies machines with at least 1 MB of memory - unfortunately DOS is limited to 640 KB. So just how do you squeeze as much memory out of a 1Mb DOS machine? *Managing Memory with DOS 5* by Dan Gookin provides the reader with a multitude of tips to help the user memory to break that ominous 640 KB barrier.

The first four chapters basically cover the hardware aspects of managing memory. After a brief tour underneath the cover, Dan Gookin describes the different types of memory chips that may be plugged into a PC. When you finally decide to buy some memory, Dan even provides you with a sample memory advertisement to illustrate what you should be wary of when making a purchase. For instance, there are 8-bit and 9-bit SIMMs, but PCs can only use the latter (8-bit SIMMs are for the Macintosh).

You probably don't want to start plugging in memory chips if you can possibly avoid it. After looking at DOS's `MEM` command and `DEBUG` (which Dan compares to 'dynamite in a baby buggy'), the reader is introduced to DOS 5 memory management.

He begins with the installation of MSDOS 5. This is followed by an explanation of the High Memory Area (HMA). There's also an explanation of how to use `HIMEM.SYS` and `EMM386.EXE`. Examples are given which illustrate how the Upper Memory Blocks (UMBs) may be maximised by utilising `LOADHIGH` and `DEVICEHIGH` in a number of 'setup scenarios', including one on how to make a 386 machine run Windows most effectively.

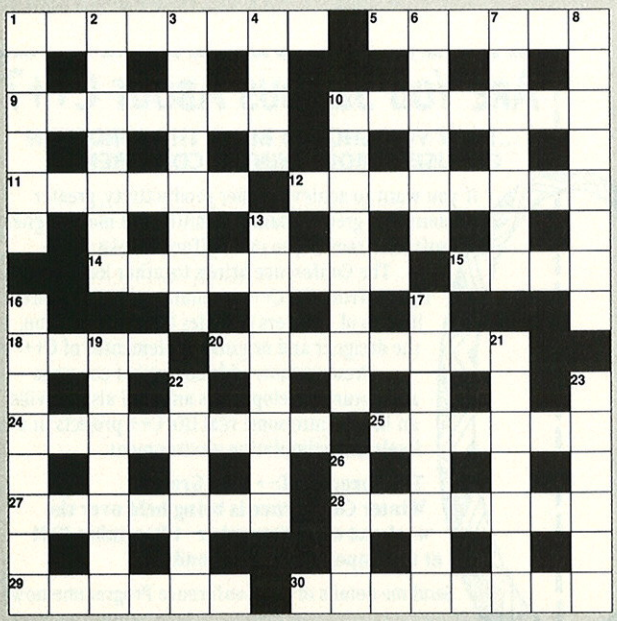
The chapter on third party memory managers covers four popular products including 386MAX, QEMM and QRAM. After a brief discription of each, the reader is provided with details of installation and optimisations, together with example CONFIG.SYS/AUTOEXEC.BAT setups.

If you have got loads of memory and you're craving for speed then Dan Gookin suggests a Disk Cache and a RAM Disk as two possible ways to increase the performance of your machine (he even goes as far as proposing that 'to make Windows really scream' you could create a 4Mb RAM Disk and copy your Windows files into it).

Managing Memory with DOS 5 provides a perfect companion to your 386/486 PC, although it does cover some memory management solutions on lesser members of the 80x86 family. Although much of the information is in the MS-DOS 5 *User's Guide*, Dan Gookin manages to present the topic of memory management in a concise way, covering both hardware and software issues. If you are an end-user who has already upgraded your machine to MSDOS 5 and would like to take full advantage of what it has to offer, Dan Gookin's little book will provide you with everything you need to know.

Title: Managing Memory with DOS 5 — *Author: Dan Gookin*
Publisher: Microsoft Press — *Price: £9.95*
Pages: 191 — *ISBN: 1-55615-381-3*

NOVEMBER .EXEWORD



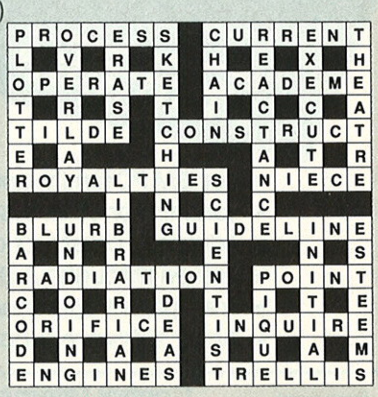
ACROSS

1 Time table for part of the OS (8)
5 Single first generation system? (6)
9 Like COBOL, jargon in brief (7)
10 Small asterisk on screen? (7)
11 A pout I take to the promised land (6)
12 Uneven work off the assembly line (8)
14 Giving up for output? (8)
15 Prince and king in a jelly (4)
18 Helps those with dread disease (4)
20 One like > who runs a mainframe (8)
24 Work of the systems folk ... (8)
25 ... livens work of those who weep (6)
27 Call again and again (8)
28 Taste of wheat dust round audio-visual 9 (7)
29 Means I hear why it goes to an agreeable chap (3-3)
30 Solid store (4,4)

DOWN

1 Position of the flag of the bosses? (6)
2 Good audio output sounds nice (7)
3 Make a hole in two ways in toothy tissues (8)
4 Current of 50 units in the LED? (4)
6 Bare Frenchman and a northern church in the shade (6)
7 Finding the worth of a variable (7)
8 Class of feline from the orient is bloody (8)
10 They transfer paper to data (8)
13 Program language on exercise I have made open to change (8)
16 Cover a conurbation to its data storage volume (8)
17 Use good guy and a little way to world wide protocol (8)
19 Before end users who give out cards (7)
21 Return VAR on ten or 51 for pasta (7)
22 Night shift (6)
23 Secretarial minister (6)
26 The other European community (4)

'.EXEWORD' compiled by Eric Deeson



OCTOBER .EXEWORD

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For further information please quote reference: G. Hastings

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For further information please quote reference: G. Armstrong

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For further information please quote reference: J. Jeffrey

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For further information please quote reference: F. Calder

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For further information please quote reference: S. Lineen

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For further information please quote reference: K. Milne

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This very successful manufacturer of computer-based scientific instruments is part of a high-profile British group and a world-leader in its field. They require a Programmer who will liase closely with application specialists in the implementation of state-of-the art computer-based analytical products. To be relevant, candidates must have at least two years experience of writing Microsoft Windows applications in 'C'. Ideal candidates will also have had a scientific background and an understanding of real-time controls together with assembly language programming skills. Self-reliance and an ability to work to tight deadlines are also important.

HRS

Contact Lionel Eras at
Human Resource Services (UK),
58 Windmill Road, Hampton Hill,
Middx., TW12 1QU
Tel: 081 941-2686 (24 hrs)
Fax: 081 941-1176

SOFTWARE PROFESSIONALS

City — **£17k - £30k**
Professional programmer needed for Global Treasury Systems. Responsible for enhancing existing products and structuring new developments using many **'C'** derivatives. Candidates should have solid **'C'** programming skills with **VMS** and **UNIX**. Package includes usual banking benefits!

Herts — **£15k - £30k**
International office software developer seeking software engineers with sound **UNIX/'C'** skills combined with some of the following: **X-Windows, MS-Windows, GUI, Graphics, E-Mail, TCP/IP, Porting, Test, Integration** or **Support.**

E. Anglia — **to £25k**
Major R&D development program requires at least 2:1 graduates and post graduates with experience in some of the following: **'C', UNIX, Real-Time, Neural Networks, C++, VOice Recognition, Speech Synthesis, OOD, DSP, OSI/X.25.**

Cambs — **to £20k**
Graduate software engineer sought with **'C'** under **UNIX** or **SunOS** and **X-Windows** under **Motif** or **OpenLook** and **Graphical** applications development (eg **CAD, GIS....**) Any experience of **C++, Voxel, Image Processing** or **OOD** useful.

Berks — **to £25k + profit share + car**
Software developer for networking and applications development. Must have following skills: **OSI lower layers** (transparent + network), **OSI upper layers** (seesion, presentation & applications - FTAM), **'C'** and **UNIX.** Any of the following an added bonus: **Event (Signal)** driven and **Finite state** engine programming or **Pascal.**

Surrey — **to £20k**
Developing the next generation of object-oriented EIS involving such issues as Open Systems, Multi-media and GUI, you should have strong 'C'/UNIX skills combined with some of the following: **X-Windows, MS-Windows, SQL databases, 4GL's** and **Graphics.**

City — **£17k - £26k**
Numerate graduate with 2 or more years work experience required with following skills: **OS/2** in **token-ring** environment, **NETBIOS** programming, **LAN Server, P.M.** and **'C'.** Following skills would be advantageous: **SQL, UNIX, Workstation User Interface, Transaction Processing** or knowledge of **Foreign Exchange** or **Money Markets.**

Wilts — **to £20k**
Renowned global developer of advanced digital systems is seeking a software engineer to work in a development/support role involved extensively with **SUN** and **X-Windows** administration with applications development using 4GL's eg Oracle or Ingres. You will need experience of **SUN, X-Windows** preferably using **UNIX** and **'C'** development tools.

W.London — **£17k - £23k**
International consultancy and world leader in **Marketing Information Systems** is seeking an experienced programmer with 3 years + experience of **Fortran** preferably under **VAX.** Any of the following useful: **Systems Analysis, 'C'** or **GIS.**

Middx — **£neg**
British leader in the development of security and control systems is actively recruiting software engineers for exciting future product developments. You should have **'C', UNIX** and **GUI** experience.

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TIMES
COMPUTER GROUP

SPECIALIST IT RECRUITMENT CONSULTANTS

◆ UNIX ◆ SUN

Our Client, an established and recognised dealership, are presently the largest **Sun** resellers in the UK. Due to expansion, they currently require four people to join a strong technical team. You should have the **ability** and **personality** to liaise with corporate customers at all levels.

◆ UNIX PROJECT MANAGER

£20K + BENEFITS + CAR **WEST LONDON**

The successful candidate will be required to provide pre and post sales support to a large customer base in London. Complete responsibility for projects from recommendations to sales team and clients to implementation and support of **SUN Microsystems Networks**. He/she must be able to work without supervision in a high pressure environment.

* Knowledge of **SUN Microsystems** current product range and **SunOS** versions.
* Field service and Hotline support experience.
* Degree of equivalent qualifications.

Ref: BD

◆ HOTLINE SUPPORT

£16 - £18K + benefits **WEST LONDON**

The successful candidate will be required to provide post sales support to a large customer base in the City of London. Complete responsibility for responding to and escalating software calls from contract clients. He/she must be able to work without supervision in a high pressure environment.

Knowledge of either **UNIX** or **Sun Microsystems** current product range and **SunOS** versions knowledge.

Field service and hotline support experience.

Excellent customer service skills.

Ref: BD

◆ TECHNICAL SUPPORT CONSULTANT

£25K + B.B's **CITY**

Our client a major financial institution current require a consultant with a broad base of hardware and software skills.

Knowledge of workstations running **UNIX** (pref. **Sun**) and **PS/2's** running **AIX** will be essential to be a success in this position.

Experience in a similar environment will be an advantage as well as a high level of educational achievement.

Ref: TS

◆ HARDWARE TECHNICAL SUPPORT ENGINEER

£18K + CAR **BRISTOL**

This leading West Country re-seller now needs a highly experienced engineer to provide support to their field service engineers.

Your daily duties will be evaluating new products, liaising with suppliers, creating technical documentation, training engineers, troubleshooting and hardware support.

Knowledge of PC's and mini's, LAN's WAN's and UNIX will be rquired in this demanding role as will a high level of education and the ability to maintain control under pressure.

Ref: TS

◆ FIELD SERVICE ENGINEER

£15K - £18K + BENEFITS **CENTRAL LONDON**

The successful candidate will be required to provide hardware sales support of **Sun** Microsystems workstations to a large customer base in the City of London. Reporting to the field service manager he/she must be able to work without supervision in a high pressure environment. Full training on the product range will be given, however, applicants with **UNIX** or **Mini** computer experience would be preferred.

* Knowledge of either **UNIX** or **Sun** Microsystems current product range and **SunOS** versions knowledge.
* Field service and hotline support experience.
* Excellent customer service skills.
* 2 years experience in high pressure/financial support environment would be ideal.

Ref: BD

◆ UNIX APPLICATIONS SUPPORT

£16 - £20K + BENEFITS **WEST LONDON**

You will be required to provide pre and post sales support on a small portfolio of software applications on Sun Microsystems platform. He/she must be able to work without supervision in a high pressure environment.

Packages: Lotus, Framemaker, Island Write Paint and Draw, dBASE, WordPerfect, Interleaf, FoxBase and Uniplex.

* The successful candidate will have knowledge of either **UNIX** or **Sun** Microsystems current product range and **SunOS** versions knowledge.
* Field service and telephone hotline support experience.
* Excellent customer service skills.

Ref: BD

◆ CONSULTANT

£18-25K + CAR + BENEFITS **NORTH LONDON**

This major dealer has an urgent requirement for **UNIX and LAN** specialists to provide consultancy to major corporate clients.

Prerequisites are strong **UNIX OS/2/NOVELL.Tapestry, Token Ring** background with good communication skills.

Candidates will probably be aged 25-40 and be able to demonstrate good management skills and a commercial acumen.

In return for these skills, a lucrative bonus scheme is offered with long term career progression.

Ref: BD

◆ UNIX TECHNICAL SUPPORT

£16-£22K + CAR **WEST LONDON**

This prestigious VAR is now urgently seeking a consultant to do pre and post sales technical support.

You will have experience of doing hotline support and troubleshooting both hardware and software problems.

Combined with at least 3 years in UNIX support a sound knowledge of **LAN's** - preferably in **NOVELL**.

Ref: TSI

◆ IMMEDIATE CONTRACT

Commissioning engineer required for rapidly expanding financial house in City. With UNIX and Sun Workstation experience.

SENIOR ENGINEER

With UNIX and Sun Workstation experience plus a degree of project management. All candidates must be well presented with a strong understanding of client liaison.

Ref: CD

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STOB - The Best Things in Life

Verity has borrowed a modem, and has been hunting among the bulletin boards for the best in freeware and shareware.

yaketyyak

Unix users will need no introduction to `yacc` - 'yet another compiler compiler' - that versatile utility without which many hours wouldn't be spent trying to get it going on anything other than the noddy example in the manual. `yaketyyak` is a public domain version, uploaded by famous programmer Ernest Dubbing, who has had an Atari ST in his bedroom since 1986. Unlike *real* yacc, which, in the honeyed words of the AT&T manual, 'converts a context-free grammar into a set of tables for a simple automaton which executes an LR(1) parsing algorithm', on my machine `yaketyyak` prints the message

```
World (c) Ernest Du
```

and then unfortunately crashes the system. However, it is provided with the full C source code, which unfortunately (again) doesn't compile. Documentation - which consists of the single line `'/* World (c) Ernest Dubbing */'` in one of the header files - is a touch on the skimpy side. You'll find `yaketyyak` in the `opinionated/bores` conference on TWIX.

WindyWord 4

Many of you will already be fans of the brilliant WindyWord windowing word processor; but did you know that you can try out V4.0 of this program absolutely free? WindySoft Inc Ltd PLC has placed a public domain version of the software on its own bulletin board (phone 0898 123 4567; calls charged at 45p a minute off-peak, set your modem to 70 baud), simply download the 2.5 MB file to your own computer and off you go! The program is *exactly* the same as the commercial version, except the facilities to load and save files have been disabled, as has the ability to print. Upgrade to the real thing for just £299!

NBG C++

NBG is a campaigning organisation which believes that it is immoral to charge money for software, and that everybody should be issued free bacon-flavoured crisps on Thursdays. Note its amusing recursive acronymic name: **N**BG's **B**og-all **G**ood. Its implementation of C++ is very thorough, but a little non-standard in some of the detail. For example the code fragment

```
int a = 4;
cout << "a = " << 4;
```

prints out 'a = 4' when compiled with Borland or Zortech C++, and 'a = 4 Free `bacon-flavoured crisps on Thursdays'` when compiled with NBG C++. NBG is represented on the ANSI C++ committee, and hopes to get its C++ extensions incorporated into the Standard. I found NBG C++ in the `verbose/bigots` area of PRIX. It comes complete with C source, which does not compile.

Smalltalk

No, not the famous object-oriented language/environment of that name, but a pointless TSR utility for use with text editors and word processors. Press the hotkey combination, and Smalltalk stuffs the keyboard with a random Essex-girl remark selected from its database, for example, 'She doesn't look good in green, but then she's a Capricorn' or 'the shopping in Basildon is so sophisticated innit'. The ZIP is complete with assembly source which, to my astonishment, *did* assemble. However, the resulting executable turned out not to be Smalltalk, but a buggy utility for removing the comment lines from early Microsoft BASIC programs. I found Smalltalk in the `nazi/sex-perverts` area on CompuSuck. It comes free with a virus which wiped out my hard disk.

For the benefit of those of you without modems, I have collected all the above programs, together with some other crummy software, onto a floppy disk. I am flogging copies at 15 squids a shot. CWO. Cheques payable to Verity Stob Money For Old Rope Ltd. In the words of Eric Idle, 'Some of us have got to live, you know.'

EXE

S'WARE DEVELOPMENT MANAGER S.Berks £Neg

Small expanding company with BS5750 developing a technical solution in C in a PC environment. You will have a C development background, be an excellent technical and man manager with ambition to reach the very top. If you are a high flyer with board level aspirations, call now.

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Established company with excellent name in GIS systems require good INGRES programmer to develop s'ware which will interface to their graphical product. Interface expertise already in-house, new project, good prospects.

S'WARE DEV' & SUPPORT ENGINEER Cambs to £20k

Developers with 2 yrs post graduate C exp' preferably with UNIX, with large scale programs with user interaction. You will have X11 & OSF/MOTIF. Should be able to spend some time abroad, French,German or Japanese would be useful. Support staff will have 2 yrs UNIX/ applications support, and should enjoy pre-sales, training & international travel.

APPLICATION S'WARE ENGINEERS S.Herts £16 - 22k

Founded fifteen years ago, our client is a market leader in with their innovative product, a multi-user graphics tool running on Silicon Graphics, Apollo and IBM RISC/6000 workstations. It uses all he latest techniques in colour imaging & giving near real-time walk throughs. Further development has generated the requirement for additional software development engineers from graduate level to senior developers.

Candidates will be very capable C programmers, ideally will have solid experience of the UNIX operating system,systems, but practical exposure to other relevant operating systems will be considered. Candidates should be self sufficiént individuals who can function with little supervision, and yet can enjoy being a small-team player. Working from a product requirement, you will be required to produce a detailed specification, design, develop and test your own software. Major re-engineering is underway, leading to modularisation, and the gateway to new products and future development in C++. Object orientated experience is of great interest, and a working knowledge of Fortran would be an added bonus.

For further information contact our Consultant Alan Hewson.
Agency applications should be directed to Questor if they wish to be considered.

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